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AMERICAN AND OTHER PATENTED INVENTIONS.

JUNE, 1830.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1830.

With Remarks and Exemplifications, by the Editor.

1. For a machine for *Sawing Barrel, Keg, and Hogshead Staves;* Daniel Toms, Auburn, Cayuga county, New York, March 2.

The saws used are bent flatways, so as to be semicircular, or in the form of a half hoop, their curvature being adapted to that of the stave they are intended to saw. A strong frame is made to support the shaft of the saws, the carriages, timber, &c. An iron shaft to which the saws are attached extends along this frame; and two semicircular saws being joined together at their ends, form a hoop surrounding this shaft; they are held in their places by two arms which extend out at right angles from the shaft; and stand upon it, therefore, like a wheel with two arms and a flat rim. The carriage and shaft may be made of sufficient length to work two such circular rims, or four saws, which may be of different sizes; these saws have teeth upon each of their edges. A vibrating motion is given to the shaft, by means of an iron arm attached to a crank. The head blocks which support the timber are of cast iron, and there is, of course, a proper feeding gear to move the carriages. If there are two circular rims as above described, four staves may be sawed at once, one by each saw. The carriage is not drawn back when the stave has been sawed off, but the timber is shifted, so as to be cut on its return by the other edge of the saw. It is observed, that by this apparatus,

limbs, and other rough timber, may be readily formed into staves, and that with a small water wheel the machine will saw four staves in a minute, to the exact curvature required.

There is no claim, a defect which, in most cases, would be fatal to a patent; but, in the present instance, as the machine appears to be essentially new in its general structure, by a liberal construction of the specification, the particular subject of the patent might be deemed to be sufficiently defined; this, however, ought never to be depended upon. Of the goodness of the machine we have little doubt, and do not know of any one with which it interferes.

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2. For an improvement in *Carriages for Rail-roads;* William P. Orrick, Reading, Bucks county, Pennsylvania, March 2.

More new, old fashioned, friction wheels. "The four large flanch wheels are made of cast iron in the usual way; each pair having an axle; these axles are turned true for the wheels to turn on, and have each two journals, also turned true, and two shoulders to each journal for the reception of the friction wheels."

"There are four friction wheels to each axle of the large wheels, and so situated on their gudgeons as to be nearly in contact with each other, and rest upon and revolve with the large axles before described."

These are in fact friction wheels of the most common kind, without an attempt at novelty. In framing the body of the carriage, the lower timbers are left so as to project out, just as they do behind a common cart, "to prevent the upper part of the bodies of the carriage striking and injuring each other when coming in contact."

"What I claim as my particular invention, is, the use of the friction wheels as above described and applied, resting on the larger axles, and turning in journals, and secured by the shoulders, whereby the main axles turn with the friction wheels at the same time the wheels turn on their axles. I also claim the use of the projection at the ends of the carriages as above described for preventing any injury from the carriages striking each other." Should such projections be left for the purpose of strength behind the mortise, as has often been done, this we presume would not interfere with the claim of the patentee, although they might even then, accidentally, keep the bodies of the carriages from contact with each other.

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3. For an improvement in the *Construction of Clocks;* James Bogardus, New York, March 2.

(See specification.)

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4. For a machine for *Reducing various articles, such as Apples for Cider, Dying Woods, Bark for Tanning, Corn with the Cob, &c. by cutting, to a degree of fineness suitable to the several operations;* David Parmelee, Reading, Fairfield county, Connecticut, March 4.

The machine for the above purpose consists of a wooden cylinder

made in radiating segments in such a manner that the end of the grain may form its whole surface—steel plates pass from end to end of this cylinder, at about three inches apart, the plates are bevelled something like a plane iron, and notched square down, so as to leave teeth with cutting edges of about one-eighth of an inch in width, and about the same distance apart. The plates are fixed in grooves, and by means of a key at one end, and a screw and nut at the other, they can be tightened, removed, and replaced. It is proposed to notch them at both edges, that they may be turned when required.

This cylinder is to be made to revolve rapidly within a trough, the cutting edges being nearly in contact with its sides; a hopper is to be placed above to feed the cutters. There is no claim.

We fancy that a stone, or other hard substance, mixed with the apples, &c. would make bad work with the cutters.

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5. For an improvement in the construction of *Iron Wheels for Rail-road Carriages;* John Finlay, Baltimore, Maryland, March 4.

(See specification.)

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6. For a machine for *Breaking and Dressing of Hemp and Flax;* Roger Halladay, Thomas Eldridge, Clemons Gibbs, and James B. Smith, Hartford, Washington county, New York, March 4.

The present patent purports to be for an improvement upon a machine for the same purpose, patented by Asa Hook, September 9th, 1823. The whole machine bears a strong resemblance to several others already in use. It consists of a large cylinder, between which and some smaller cylinders the material to be broken and dressed is to pass; besides these small cylinders there is also a piece of timber of the whole length of the large cylinder, forming a segment of $\frac{1}{16}$ of a circle, between which and the cylinder the flax or hemp is operated upon. The explanation is deficient in clearness, and the drawing is very indifferently executed. The claim, which is as follows, is, we think, in terms much too general and indefinite.

"The improvements we claim are as follows; by enlarging and adding to the frame; by attaching the beaters on a cylinder and dressing at each end; by using a sixteenth part of a circle, and combining together the small fluted cylinder, and the sixteenth part of a circle to form what was called in the flax machine a quarter circle. And finally, we claim as inventing and combining together all that is here specified, or noticed in the draft, which was not patented to Asa Hook, on the 9th of September, 1823, which is the original patent of which we wish for the patent for the improvements on."

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7. For a *Machine for Making Brick Mortar;* Amos Parker, Sweden, Oxford county, Maine, March 5.

This machine is similar to, at least, one other which has been pa-

tented. It consists of a wheel running in a circular trough, within which the clay is put. From a vertical shaft in the centre of this trough, a horizontal shaft projects out, which is to be drawn round by a horse; on the body of this shaft a screw is cut, which passes through the centre of the roller, or wheel, which is to grind, or mix the clay. When the horse passes one way, the wheel recedes from the outer part towards the centre of the trough, and on turning the horse, it returns back again.

There is no claim whatever, and the description is, in great part, taken up with minute measurements, not one of which is essential, or important. What is given as a drawing does not deserve the name, being a mere scratch, those parts which are vertical, and those which are horizontal, are all laid down on the same plane.

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8. For a *Churning Machine;* Henry Schively and Robert M'Euen, Frederickburg, Wayne county, Ohio, March 6.

A shaft, with dashers standing at different angles, is turned round by means of a crank, attached to a multiplying wheel. There is certainly little to claim in it, and nothing is claimed; something called a drawing accompanies the specification, but it is without written references.

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9. For a *Wooden, or Framed Bridge;* S. H. Long, Baltimore, Maryland, March 6.

(See specification, page 231.)

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10. For a *Folding, Pocket Tooth Brush;* Philos Blake, New Haven, Connecticut, March 8.

A very particular and clear description of this brush and case are given, which, however, we do not think it necessary minutely to follow. The part which forms the handle is united to that containing the bristles by means of a pivot, enabling them to fold upon each other. The lower part of the handle has attached to it a metal, or other case, into which the brush passes, there being a lid hinged in the manner of a snuff box lid, to shut it neatly up for the pocket. The patentee says:

"I do not claim to have originated the idea of making a tooth brush portable by enclosing it in a case, nor that of making the case serve the purpose of a handle when it is used, but I do claim the invention of connecting the brush to its case by a pivot, or revolving joint. I also claim as my invention the improvement or construction as herein described, of the several parts by which the brush and its case are respectively adapted to this mode of connecting them in a new form, firm in use, and more compact and convenient for the pocket than any other."

We should be very apprehensive that tooth brushes made as described by the patentee, must be sold at a price which would prevent their employment to any considerable extent. We have seen brushes

with a screw handle, and a small case, offering, we think, all the advantages proposed, and recommended by their greater simplicity; but even these we have rarely seen in use.

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11. For an improvement in the *Construction of Steam Boilers, Stoves, Chimnies, &c.;* John James Giraud, M. D., Baltimore, Maryland, March 8.

If the apparatus described accomplishes a moiety of what is claimed for it, its value will be very great. It is, "1st, to produce as great a quantity of steam as an ordinary boiler of three times its size usually produces. 2ndly. To reduce the consumption of fuel, so that only one-sixth of the quantity of wood usually required will be necessary. 3d. To overcome as much as possible the dangers arising from the bursting of boilers under high pressure. 4th. To render the boilers durable. 5th. To afford the greatest convenience for cleaning boilers. 6th. To prevent the crust from forming on the internal surface of the boilers by the sediment from the water, whereby a great obstacle is created to the heat. 7th. To create an almost instantaneous heat. 8th. To burn and decompose the smoke, the flame having to pass through pipes intended to convey off the smoke."

Kettles for factories of all sizes and descriptions, stills, and other similar apparatus, are to be constructed on the proposed principle.

The furnace has nothing peculiar in its structure. The upper part of it is covered with a plate of cast iron, perforated in the centre to receive a conical or cylindrical cap, into which the flame and smoke pass. The iron plate extends out horizontally to a considerable distance, to receive the *bell* and *dome*, which form the *boiler*. The piece called the *bell* is placed over and surrounds the cap, allowing a space of some inches between the two. The lower edge of the bell is secured steam tight to the iron plate. Over the bell is placed another covering, nearly hemispherical, called the dome; this is secured to the plate in the same way with the bell. The space between the bell and the dome is to contain the water which is to be boiled. The flame and smoke pass up through the cap, then down between that and the bell, and then again up, through pipes which are made to pass through the water, and have their exit at the vertex of the dome. This is the *steam boiler*.

A *stove* is described, which, by the aid of concentric cylinders and drums, is supposed to offer all the advantages ascribed to the steam boiler. We are unable to perceive in what way the above described boiler and stove are to attain all, or indeed either, of the proposed ends, nor does the description lend us any aid in this respect.

The claim is in the following words.

"The *principle* I claim, is, to concentrate the heat, by causing it to travel upwards and downwards through narrow passages, and to be conveyed by pipes of any length, and through any substance or matter."

Whatever merit or utility there may be in the apparatus described,

appears to be completely lost sight of in the claim, and the naked principle, or rather plan of conducting heated air upwards and downwards, through narrow passages, which is perfectly familiar to all persons conversant with the subject, is set up as new.

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12. For an improved *Grist Mill;* Aaron Porter, New London, Jefferson county, Indiana, March 10.

The patentee has denominated his patent "an improvement in the art of milling," and then gives the "construction of the said machine." The said machine is merely a small grist mill, in which the lower stone is to be the runner; and we are told that by increasing the velocity of the stone, one of twenty inches diameter, may be made to perform as much work as one of 40 inches upon the old construction. There is no novelty whatever in the plan of this mill, and the specification is made in accordance with this fact, as there is no attempt to point out any, and consequently no claim.

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13. For a mode of *Manufacturing Woollen Slubbing* at one operation, direct from the card; Charles Atwood, Middletown, Middlesex county, Connecticut, March 10.

(See specification.)

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14. For an improvement in the *Manufacturing of Bench Plane Irons;* William Hovey, Boston, Massachusetts, March 10.

Steel is to be welded on to a bar of iron, extending its whole length; this bar is then to be rolled down to the thickness of the thick part of a plane iron; it is then to be cut into proper lengths and passed through eccentric rollers, so formed as to give to the iron its proper taper, after which the finishing is effected in the usual way. The claim is to the giving of the taper by eccentric rollers.

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15. For an improvement in the *Frame Bridge;* George W. Long, of the United States Army, Fort Jackson, Louisiana, March 10.

(See specification.)

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16. For an *Oval Churn;* John Oothout, Lebanon, Madison county, New York, March 10.

This churn has two vertical shafts with dashers, fixed in the manner of that represented and described at page 261, vol. ii. new series, patented by Joseph Hathaway, August 23, 1828. That churn it was proposed to turn by whorls and a band, but the one now under consideration has, instead of whorls, a cog wheel at the upper end of each shaft, which take into each other, and, of course, turn reverse ways. To these cog wheels motion is given by a vertical wheel, which meshes into one of them, and is turned by a crank; it is essentially

the same as the former churn in its internal structure; the only difference being in the substitution of cog wheels for whorls and bands.

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17. For improvements in the *Plough;* Robert Walker, Washingtonville, Columbia county, Pennsylvania, March 10.

The specification describes the whole plough; the improvements claimed are as follow.

"The improvements for which I claim a patent, are, 1st. The deep locking of the joint between the land side and mould board, by which the mould board and land side receive mutual support. 2nd. The brace which confines the sheath in its proper angle, passing through the beam in front of the coulter. 3d. The curved form of the coulter."

It may, and often does, answer the purpose of a manufacturer to have the name of *patent* attached to the productions of his workshop, and this is undoubtedly the motive, in many instances, for obtaining one; in such a case the manner of curving a coulter, fixing a brace, or strengthening a joint, may serve to fill up a form, and make a claim.

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18. For a *Machine for Cutting Crackers, Sugar Biscuit, or other Bread;* James Cooper, Philadelphia county, Pennsylvania, March 11.

Cutters of an hexagonal form are united so as to cut nineteen or more crackers, or other biscuits; prickers and clearers being fixed as usual. The dough is to be placed upon a platform; the cutter is then brought down on it, and pressure made by lever, or other power.

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19. For a machine for *Washing and Cleaning Hats;* William Carlock, Baltimore, Maryland, March 12.

Two cages formed of ribs, which are elastic, are made to revolve horizontally, by any suitable means, in a trough containing water. Within these cages the hats to be washed are placed. The patentee says,

"What I claim as my peculiar invention, is, the application of machinery to the purpose of washing and cleaning hats of all superfluous colouring matter, and particularly for the use of springs, or slides, in the construction of a machine for the purpose; as also for all other parts of the machine described in my specification."

This claim is much too broad and indefinite. In the first place, the washing of hats by machinery is claimed. If this can be sustained, certainly nothing more is necessary; this, however, is rather hazardous. The claim to all other parts of the machinery is a claim to cranks, cog wheels, &c., without regard to any particular combination, and must, therefore, be taken to mean nothing.

20. For an improvement in the *Making and using of Printing Types;* Lemuel Blake, Boston, Massachusetts, March 12.

The improvement claimed "consists in the uniting of two or more letters on one type body; the said two letters so united forming or composing a word in the English language, as well as being component parts of an immense number of other words, and consist of the following, viz. am, as, at, by, do, he, if, is, it, me, my, no, so, up, us, ye, we. And also the following not composing words, but of frequent occurrence, viz. ed, er, ll, ss, qu."

A plan of the case to hold the extra types accompanies the specification.

On the 9th of February a patent was granted to William Collier, of Boston, the principle of which is precisely the same with the foregoing, and embracing in the enumeration of combined letters the whole of the above, with the exception of four. We must leave the patentees to settle the question of which, or whether either, is the true and original inventor. To the printers will belong the determination of the extent to which such combinations may be carried, without extending their cases to an inconvenient size, or rendering them too complex. It is only for particular combinations, that patents can be claimed, (we will not say sustained,) as the practice of combining two or more letters is as old as the art of printing.

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21. For an improvement in the *Bee Hive;* Ebenezer Beard, Charlestown, Middlesex county, Massachusetts, March 12.

The hive recommended is a double, square hive, one compartment being placed upon the other, with a division between them. In the upper division there may be four different compartments, formed by four separate boxes, which are placed with their mouths downwards. The communication between the upper and lower compartments may be opened or closed by means of slides; they are left open until the bees have filled a box with honey, when the slide is closed, and the bees within the box confined there; after "a few hours the bees in the box will become tame and harmless, in consequence of being shut out from their queen. The box may be then removed by lifting it out of the chamber, and setting it by, inverted;" the bees will return to the hive, the box may then be emptied and replaced, the slide drawn out, and the work proceed as at first. So says the patentee. There is no claim.

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22. For a *Horizontal Water Wheel,* called the "Union Water Wheel;" John R. Wheeler, Pittsford, Monroe county, New York, March 15.

A wheel of six feet in diameter is selected for the purpose of giving a description of the proportionate measurements of one of any other dimensions. Two rims are made, each eleven inches in depth, the outer rim forming the exterior of the wheel, the inner one of such diameter as to allow a space of nine inches between them; this

space is to be occupied by the buckets, which are recommended to be of iron, and are to be let into each rim, in grooves of half an inch in depth. The buckets are not to be inclined planes, but are to be curved. The inner framing of the wheel consists of four pieces of plank, which are halved and grooved together, so as to leave a square hole for the vertical shaft to pass through, whilst their ends project out, and form the arms which are grooved into the inner rim. The claims are to

"1st. The manner of making and putting together the arms."

"2nd. The iron buckets."

"3d. The shape of the buckets."

"4th. The manner of letting them into the rims."

We see no novelty in either of these, excepting it may be in the third, and in this nothing with the exception of the *particular kind of curve* designated, which may certainly be departed from without injury to the wheel, and probably with advantage.

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23. For a *Thrashing Machine;* Rudolph Miller, Marietta, Lancaster county, Pennsylvania, March 15.

This is another variation of the kind of thrashing machine most commonly patented. The beaters, which form the outer part of a revolving cylinder, are made to slide in grooves in the circular heads to which they are attached, so that they may give way when they strike the straw. The hollow segment is formed of iron bars, let into, and supported by, wood. The claim is to "the machine as before described; the cylinder of beaters with the mode in which they are made to rise and fall in their dovetail openings. Also the mode in which the bed is constructed."

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24. For a machine for *Cutting Crackers, Sugar and other Biscuits;* Thomas Bladen, Philadelphia, Pennsylvania, March 16.

This differs from the cutting apparatus No. 18, patented five days previously, in making the crackers, &c. round, instead of hexagonal. In that plan there was no waste dough between the biscuits, but in the present, triangular pieces must be cut out between the joinings of the circles. The bed of the press upon which the cutting is to be effected is formed of a plate of metal which is pierced entirely through to allow of a passage for the waste dough into a receptacle below; the circular parts which are to support the cracker being left solid. An upper steel plate, of two inches in thickness, forms the cutter; this is perforated with nineteen circular holes, of the size of the biscuit, the triangular spaces between them being left solid; the perforations are in the cutter, and, therefore, the reverse of those in the bed over which it is to be placed. The press used has the necessary fixtures for placing the cutter so that it may, with perfect accuracy, be pressed down upon the bed.

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25. For an improvement in *Quadrants and Sextants;* Phineas Spear, Portland, Maine, March 19.

The apparatus described is to be attached to the off limb of a quadrant, or sextant, by means of suitable pieces of metal, which are to sustain "a fog glass," that is to stand vertically, and opposite to the horizon glass and tube of sight. "A horizon bar" is to be fixed across this glass, and a *spirit level* stands upon one of the pieces of metal which attaches the fog glass to the limb of the instrument. Adjusting screws are placed to regulate the level, the fog glass and the horizon bar.

"*Use of the apparatus.*—The *horizon bar* in the *fog glass* having been adjusted to the horizon by observing through the tube, or sight, (whilst the bubble is in the centre of the level) that the horizon bar is in the plane of the observer. The observer then brings down the celestial object in the usual way, till it touches the horizon bar, observing at the same time to keep the instrument level, by means of the level," &c. &c.

The advantage contemplated, is, the taking of the altitude of the sun, &c. in hazy weather. The claim is to the fog glass, the horizon bar, and the use of the level.

A careful adjustment is requisite, even with a fixed instrument, such as a theodolite, to place it perfectly level; how this can be effected by a quadrant or sextant held in the hand of the observer, we cannot perceive, and are convinced that the present plan will add one to the unsuccessful attempts at forming an artificial horizon.

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26. For machinery for *Dressing Staves and Heading*, for barrels, casks, &c.; Abner Stearns, jun. Schaghticoke, Rensellaer county, New York, March 22.

The specification of this patent occupies twenty-eight closely written, foolscap pages, which we have not yet found time to read. We will take it up at an early day, and should we in the multitude of words in which the description is enveloped find any new ideas likely to benefit the formers of barrels and casks, we will endeavour to convey them in fewer words.

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27. For a *Churn;* George Sowle and Peter Brewer, Blenheim, Schoharie county, New York, March 22.

Dashers are to be turned horizontally in a vertical churn, by means of a cog wheel and pinion. There is nothing to claim, and nothing claimed.

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28. For an improved *Boot Crimp;* Jonah Brewster, Worthington, Hampshire county, Massachusetts, March 23.

This boot crimp is a sort of double pincers, to be used with the common *boot crimper.* The crimp is in form something like a staple, with a space between its two straps, or sides, sufficient to embrace the crimper. The leather is secured to each of these straps, by a second strap hinged, one on each, and screwing down so as to embrace the leather like a vice, or pincers. A long thumb screw passes

through the head of the staple, and bears upon the edge of the crimper, and by turning this screw the crimp recedes, and the leather is drawn to the desired form.

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29. For a *Machine for Thrashing* and cleaning grain; Thomas Ingersoll, Murray, Orleans county, New York, March 23.

We will first give the claim made by the present patentee, which is as follows.

"The cast iron shell of the cylinder, with cast iron teeth solid on the shell, and the shape of the teeth; the rake, and riddle, and grates, and the manner of uniting the winnower to the thrasher so as to perform the thrashing and winnowing at one operation."

The general construction is the same as usual; the cast iron shell, is what we have usually called the concave segment; the rake, and the winnower, which are attached, have been repeatedly combined with the thrashing machine, and that in a manner so nearly resembling the present as to render all claim to novelty very doubtful.

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30. For a *Thrashing Machine;* William Corwithe, New York, March 23.

There are feeding rollers and a revolving cylinder which carries the beaters, as usual, but the beaters instead of being bars extending from one end of the cylinder to the other, are rows of short flails connected to such bars by means of staples and thongs, allowing them to play freely. These flails are about six inches in length, and strike upon a bed, or floor, upon which the grain is fed by means of rollers. The claim is to the general *merits* of the machine, "and more especially for the manner in which the flails are appended to the cylinder, and operate during each revolution."

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31. For improvements in the *Fanning Mill* for cleaning wheat, rye, oats, &c.; David Sears, Franklin, Delaware, county, New York, March 24.

This fanning mill does not differ materially from those in general use, but is supposed to exhibit an improved arrangement of certain parts, pointed out in the following claim.

"*First.* The construction of the shoe which receives the grain from the hopper, by the insertion of wires in such a manner as to prevent the straw and heads of grain from obstructing the riddles."

"*Secondly.* The apparatus communicating the vibratory motion to the shoe containing the riddles."

"*Thirdly.* The general form of the machine, caused by such a disposition of its several parts as to render the whole more light and compact than any machine before invented for the same purpose."

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32. For machinery for *Sawing Clapboards;* Ebenezer Carlton, of Bath, and Solomon Whiting, of Littleton, in the county of Grafton, New Hampshire, March 25.

The same name is used in different parts of the country, for very different articles, and this of course has a tendency to lead persons into error; the term clapboards, in many places, means rough shingles, or other rived boards; in the present instance, feather edged weather boarding is the article intended. Mr. Eastman, of New Hampshire, obtained a patent for cutting weather boarding of this description from a round log by means of a circular saw, the log being sustained on centres so that it might be turned round, and the plank cut in radii towards its centre. The saw used in the present machine is also circular, but the weather boarding is to be cut from a log first prepared at a common saw mill, where it is to be cut of a thickness equal to the width of the intended weather boarding. The log so cut is to be placed upon a carriage which is to be made to advance by means of a rack and pinion much in the usual way; the log, however, is fixed upon rockers, contrived for the purpose of canting it, at the end of every cut, so that a thick and thin edge may alternately be formed at each surface. From the employment of this contrivance the patentees have named their machine the "*Tipping Clapboard Machine.*"

There is not any part specifically claimed, and for want of a better drawing the description is imperfect, although it is manifest that pains have been taken to explain it in words. The drawing is in fact wretchedly executed. Patentees are not generally aware that according to our law, the drawing makes *a part of the specification.*

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33. For a *Still Spindle and Can Roping Machine;* John Irwin, Coventry, Kent county, Rhode Island, March 26.

The arrangement of this machinery resembles that of the "*Can Spinner,*" patented by Mr. John Thorpe, of Providence, Rhode Island, (see p. 65, vol. iv. new series,) as will be seen by the following description, abstracted from the specification of Mr. Irwin's patent. A still spindle has a case, or can, which may be of tin, fixed to the top of it; the can in use is said to be about 7 inches deep, and four inches in diameter. A spool is made to run on the spindle by means of a band, which spool receives the roping from rollers in the common way. The spool is made to rise and fall within the can by means of a waive rail. It is stated that "bobbins for *weaving*, and for other purposes, may be filled also in this same mode."

The claim is to "the *application* of the above described machine to *making roping.*"

It would seem from the foregoing claim that it is not intended to represent the invention as new, but merely the application of it to roping. We should doubt the validity of this claim, as the machinery itself is patented by Mr. Thorpe, who says, "the improvements consists of a cup, or can, placed on the top of a dead, or still spindle, around the surface of which the yarn revolves, being drawn by the bobbin as it twists and receives it." "The bobbin may be either a *weaver's* bobbin, or a common spindle bobbin."

The drawing is without written references; the part intended to

represent a spindle would never be taken for one, nor is the manner of fixing the can, shown.

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34. For machinery for *Bending Wagon and other Tire;* Lester Butler and Isaac Hinkley, Cobleskill, Schoharie county, New York, March 26.

The whole of the specification is comprised in the following words.

"Instead of having the bed and notch pieces, on which the under rollers run, stationary, and the rollers varied by moving them on said notches, which are an inch or more apart, as those in use are, the under rollers are regulated by placing them on slides, with one notch on each slide, which are moved by means of a screw on each end of the bench or platform, on which the slides and rollers are placed. By this method the under rollers may be varied so as to bend to any diameter you please."

The drawing affords little or no aid in explaining the machine; the general nature of the improvement, it is true, may be collected from the above brief description.

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35. For a plan for *Propelling Land Carriages by means of Steam;* Simon Fairman, Nassau, Rensellaer county, New York, March 27.

The specification and drawings belonging to this patent have been prepared with much care, and occupy considerable space, as the structure of the carriage, the propelling machinery, and the steam engine, are all particularly exemplified. To make known these particulars would require the whole specification with its drawings. It is well known that in England several different engineers have been for some years engaged in endeavouring to effect the object for which the present patent is obtained, and that a carriage has actually run to a considerable distance on a common turnpike road, surmounting the ascents, and carrying considerable weight; still the invention is far from complete there, although more has been done than we formerly believed to be possible, and the practicability of running a carriage upon good roads has been demonstrated. We are of opinion that it would have been more prudent to wait for some further experiments at the expense of those who have the thing in hand there, than to commence here a similar career, which will undoubtedly cause the expenditure of large sums, as many abortive essays will be made before complete success is obtained; more *good luck* than usual must be experienced should not this be the case.

From our recollection of some parts of the carriages constructed in England, we are apprehensive that there are claims made by the present patentee, with which they will interfere; we also think some of the claims too broad, they are as follow.

"The parts which I claim as composing the several items of this my improvement, are the *platform* with all the variations which may be necessary to adapt it to each and every kind of land carriage, together with all the superstructure herein specified; the *hind wheels*

and revolving axle, and all the intermediate machinery between them and the steam engine, together with the *ratchets*, the *friction band*, and *expanding corks;* the steam engine so far as it differs from those in common use, and the boiler and generator."

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36. For *Generating Steam for Distilling*, and other purposes; John White, Logan county, Kentucky, March 29.

The apparatus intended to be patented is obscurely described, and but indifferently drawn. It is to consist of a wooden cylinder made in the form of the cylindrical boiler of a steam engine, but only 3 or 4 feet in length. An iron cylindrical furnace is inserted in one head of the boiler, in the manner which has been frequently practiced; from this furnace, flues lead backward and forward through the liquid contained in the wooden cylinder. The claim is to "the particular arrangement of the above named apparatus, and also the application of it to the distilling of spirits."

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37. For an improvement in *Trusses for Ruptures;* Seymour Marsh, Canajoharie, Montgomery county, New York, March 29.

There are two pads attached to a steel spring of the ordinary form; one pad to bear against the rupture, the other against the back. The front pad is hinged to the steel spring, and has a small spring attached to the iron plate which forms the back of it; this spring, at its opposite end, bears upon the hinge, upon which it acts by means of a small friction roller. The hinge is attached to the truss spring by a screw and nut, sliding in a slot, to adjust it so as to fit exactly on the part required. The back pad is also adjustable by means of a nut and endless screw. An elastic strap passes round the side of the body opposite to the truss spring, to which it is attached by buttons in the usual manner. The claim is to "the action of the spring aforesaid, fastened to the front pad, upon a friction roller, to adjust the same; and the endless screw which governs the rear, or back pad, and which by the assistance of the screw can be moved at pleasure to avoid friction at any one place."

The drawing is sufficiently well executed, but is without written references.

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38. For an improvement in the *Manufacture of Hats*, consisting in the stiffening thereof; Samuel W. Williams, Elizabethtown, Essex county, New York, March 30.

The process employed is similar to that now extensively used, in which shellac is dissolved in an alkali, applied to the hat in this state, and the alkali neutralized by sulphuric acid. In the present instance, however, copal and rosin are added in certain proportions, and it is said that this plan is more economical than that generally followed. The claim is to the adding these two resins; the mode of combining them; the relative proportions in which they are used; and to the mode of applying the stiffening.

39. For an improvement in the *Fluked Harrow Tooth;* Samuel Tam, Milton, Sussex county, Delaware, March 30.

The patentee says, "what I claim is the making the flukes of cast iron; hollowing or curving them near the middle; also in curving the shank, and giving it a sharp edge; by means of which improvements the flukes work clear, and wear sharp; also the shanks being sharp, cut the earth, and never clog after they are worn bright."

Excepting the giving to each side of the fluke a form something like that of the mould board of a plough, and the making them of cast, instead of wrought, iron, the whole harrow is of the common construction; the change from wrought to cast iron, we apprehend, cannot be sustained. The fluke as shown in the model and drawing, has its cutting angle so obtuse, as to present a resistance which must make it very hard to draw excepting in a very light soil. It may be an improved harrow, but to us it does not wear the appearance of being so.

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40. For machinery for *Cutting the Screws of Gimblets;* Charles Daniels, assignee of William W. Southworth, Saybrook, Middlesex county, Connecticut, March 30.

A burr, buzz, or cutter, of cast steel, grooved on its cutting edge so as to form two cutters, is made by proper means to revolve on an arbor. The gimblet to be cut is held on the end of another arbor, which has vice jaws for that purpose; the axis of this is somewhat inclined to that which carries the cutters. The back end of this arbor has a male screw formed on it, and passes through a collar with a female screw, so that when the arbor is turned by means of a crank, the point of the gimblet advances against the cutters which form the double screw at one operation. The claim is to the cutting the double screw at once; a similar machine, with a single screw, having been heretofore in use.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the Construction of Clocks. Granted to JAMES BOGARDUS, *New York, March 2nd,* 1830.

To construct this clock, he makes a wheel, which he calls the first wheel, to carry the hour hand, revolving twice in a natural day; and he gears with this a pinion which shall throw another wheel, which he calls his second wheel, twenty-four times round while the first revolves once, being twice as fast as the minute hand should revolve, running of course in the contrary way from the hour hand wheel.

Then he gears a pinion of twice the number of teeth with the pinion on the axis of the second wheel, which pinion of twice the number of teeth as aforesaid, running the right way, will give the

minute hand fixed to its axis the proper number of turns, or seven hundred and twenty, to the single revolution of the hour hand wheel as aforesaid. The said second wheel being geared by the pinion aforesaid to the hour hand wheel, and revolving twenty-four times, as aforesaid, by means of the pinion, must be made of such diameter and number of teeth, and be so geared with the scapement wheel, which said Bogardus calls his third wheel, by means of a pinion on the axis of said scapement wheel, as to throw round the said scapement, or third wheel, thirty times at each turn of the said second wheel, and thus all the hands fixed to the said three axes respectively, will revolve together the required number of times. For convenience, the axis of the wheels and pinions are placed vertically above each other, the hour hand lowest, and the second hand highest. The wheel that carries the hour hand has a tube fixed in its centre through which the axis of the barrel is made to operate. The barrel secured to its axis, is connected with the hour hand, or first wheel, by a click on this wheel, which takes into a ratchet wheel fixed to a barrel. The axis of the barrel must be made with a square on its outer end, outside of, or within, the tube of the hour hand wheel, or first wheel, on which square, by means of a suitable key, the clock is wound up.

The principle of this improvement, or invention, consists in this, that the wheel which carries the hour hand, as aforesaid, and the barrel for the chain, or cord, or main spring, turn on a common centre and are combined with the two other wheels and three pinions constructed with such relative proportions as aforesaid, that the three hands marking the hours, minutes and seconds, shall be carried on three several axes as aforesaid, by a weight or spring applied to the barrel, and a pendulum or balance applied to the scapement wheel in any common form, so that the hands shall mark with precision their respective portions of time.

Clocks have been made with three wheels before, and of these a description is in Rees' Cyclopedia; but no clock has ever been made with three wheels to carry the three hands, or the hour and minute hands only, so that the said Bogardus contemplates the application of his principle for the construction and application of the aforesaid combination, to effect the motion of the hour and minute hand, as well without as with the second hand.

The said Bogardus further specifying the principle of his invention, observes, that he does not include, as an essential part of his invention, any particular forms or positions of the parts, nor any particular mode of construction in common use of known parts of horological machinery, these being susceptible of great variety without difference in principle, but he claims the application of the principle of his combination to all machines for marking portions of time, whether of the larger kind, as clocks, or of the smaller kind, as watches, or of those called chronometers.

JAMES BOGARDUS.

Specification of a patent for an improvement in the construction of Iron Wheels for Rail-road Carriages. Granted to JOHN FINLAY, *Baltimore, Maryland, March* 4, 1830.

THE wheel consists of, 1st, the hub, 2nd, the spokes, 3d, rim, or tire, 4th, screws, bolts, or rivets, by means of which the bolts are secured.

1st. The hub is cast of iron, brass, or any suitable metal, with the grooves to receive the spokes cast in it.

2nd. The spokes are made of wrought iron, or any other suitable metal, round, oval, or any other figure. One end of each spoke is made to fit into the groove in the hub, before mentioned; the other end is made to fit to the flanch of the rim of the wheel, and secured by bolts, screws, or rivets.

3d. The rim, or tire, has a flanch on the inner side, in or near the centre, to which the spokes are secured; it has likewise another flanch on its periphery to adapt it for rail-roads; the whole is made, or cast together.

The different parts of the wheel having been prepared, the spokes are fitted into the grooves in the hub, and secured in their places by bolts, screws, rivets, &c. The other ends of the spokes are fitted to the flanches, and also secured in their places by bolts, screws, rivets, &c.

Invention claimed.—What I claim as my invention or discovery, are the wrought iron, or other metal spokes, with the manner in which they are secured to the hub and periphery of the wheel, and by which they brace and strengthen the wheel. JOHN FINLAY.

Remarks by the Editor.—In the drawing accompanying the foregoing, the spokes are represented as double, one rising behind the other from each end of the hub, and uniting at the flanch within the rim; this, however, is not mentioned in the specification, and as it is a well known plan, does not, we suppose, make any part of the patent. We do not in this wheel perceive any improvement upon some others which are now in use. If the whole wheel is to be made of cast iron, it would be cheaper, and more firm if cast in one piece. All danger of breaking the spokes from unequal contraction in cooling is easily obviated by giving them a curved form. If the rim and hub are to be of cast, and the spokes of wrought iron, the plan adopted by Mr. Perkins obviates every difficulty resulting from the shrinking of the rim. He first casts the rim, with the wrought spokes inserted in it, and after suffering this to cool, so as to contract completely, he casts the hub, embracing the inner ends of the spokes. In this way any degree of lightness may be attained, combined with perfect solidity. We do not recollect having seen the description of the wheels patented in England by Messrs. Jones & Co., but from the manner in which they are mentioned, and from their having been adopted by Messrs. Braithwaite and Ericsson, in the carriage of their locomotive

engine the NOVELTY, we apprehend that they combine strength with lightness in an eminent degree.

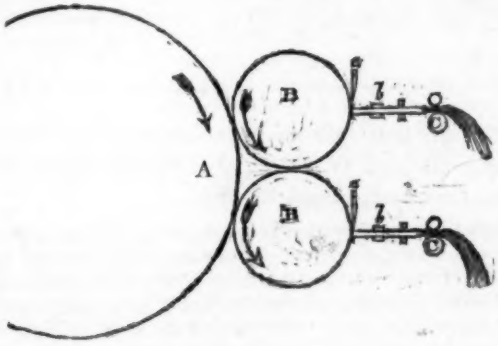
It frequently happens that in country places inventors have no opportunity of consulting Journals, or other works which would inform them that they have been anticipated in their inventions, or that even better things are known and used than those which they have devised. The world is large, and men in other countries possess genius, and are alive to the promptings of interest, whilst the press, in general, makes their inventions known at an early day; our large cities all furnish the means of information on such points, yet few of those who are interested appear desirous to avail themselves of the proffered advantage. It is no speculative opinion, but a fact confirmed by repeated observation, that individuals who think, or hope, that they have hit upon something new, are unwilling to be undeceived; we have known them refuse to look at a book, a specification, or a model which would have proved to them their error. This is not a rare, but a very frequent occurrence. There also seems to exist in the minds of many, an idea that when their contrivances are patented, this circumstance alone, independently of any intrinsic merit, will stamp upon them the evidence of absolute value. The greater number, however, of those who obtain patents, find to their cost, that they have purchased a barren field, the harvest from which will not be equal to the seed they have sown in it.

We have not made these remarks with particular reference to the preceding patent, which has merely served as a text, to enable us, like some others, to talk about things in general. We do not, it is true, as we have plainly indicated, think that it offers any *great* improvement, but those who are in the habit of reading our monthly lucubrations, are aware that we do not believe that great inventions or discoveries are numerous.

Specification of a patent for an improvement in the mode of making or manufacturing Woollen Slubbing at one operation, direct from the card. Granted to CHARLES ATWOOD, *Middletown, Middlesex county, Connecticut, March* 10, 1830.

THIS discovery or invention is an improvement on the wool carding machine as fitted for the common condenser, having two doffers clothed with filleting cards in such a manner that the space left between the fillets on the upper doffer are cleared by the fillets on the lower. The comb, and the tube or belts, or any other twisting apparatus, may be used conjointly to clear the doffers. And the improvement for which a patent is now prayed, consists in giving the doffers a motion exceeding that of the rolls or other apparatus which takes away the work; accumulating the wool by this means on the fillets of the doffers at the point where it is taken away. We are enabled to convolve, writhe, or twist it as it accumulates, and each turn as the wool accumulates lays the fibres of the wool in a spiral form,

leaving one turn of twist in the slubbing, and the degree of twist and the spiral form of the fibres will be as the difference of motion between the surface of the doffers and the rolls or other apparatus which draw away the slubbing, and may be varied to any degree sufficient for all the purposes desired or necessary for slubbing, and no condensing or rubbing is necessary to give it strength, and it may be packed on the large spool for the Jack, or on separate spools for the Brewster, or Jenny.



Suppose the arch A, to be a section of the main cylinder of the carding machine.

B, B, the two doffers moving as shown by the arrows.

a, *a*, the combs vibrating with a perpendicular motion.

b, *b*, the tubes.

C, C, the rolls for drawing away the work.

Now give the surface of B, B, and C, C, the same motion, and it is evident that the quantity of wool received on a fillet on B, B, at the point of contact with the main cylinder will be carried round until it meets with the twist given by the tubes *b*, *b*, and the stroke of the combs *a*, *a*, when it will be taken off by the roll C, C, just as fast as it comes to the tubes and combs, and the fibres of the wool will lie as they do on the doffer before the contact, and there can be no twist left by the tube, as the thread at each end will receive the same number of turns, and none will be thrown out; but increase the motion of B, B, say one third, and the quantity of the wool on the doffers between the point of contact with the main cylinder and the tube and comb will be lessened one-third, and as it is drawn away no faster by the rolls C, C, than before, it will accumulate at the tube and comb, and the motion of the tube will convolve or twist it as it accumulates, and cause the fibres of the wool to take a spiral position in the thread, and at each turn, in thus thickening and forming, one turn of twist will be left in the thread at the out end of the tube, and it will pass to the rolls C, C, and from them to the spools, just as heavy and large a thread as before the motion of B, B, was altered, but in the new form and twisted; and it will be obvious that just in

the proportion that the speed of B, B, exceeds that of C, C, will be the new result as stated above.

The advantages of this improvement, are, the laying the fibres of the wool more spirally, or more like the common roll from the card than any other method of making slubbing; it is consequently more easily opened and drawn in the spinning process, produces a finer and better thread, it receives all necessary solidity and strength from the twist without the injurious felting of the condensing rubber, the flannels from it felt better in the stocks, and the cloth finishes with less giging than that made by any other method heretofore known.

CHARLES ATWOOD.

Specification of a patent for an improvement in the Frame Bridge. Granted to GEORGE W. LONG, *of the United States Army, Fort Jackson, Louisiana, March* 10, 1830.

THE object of the invention is to acquire great strength in a bridge by means of a frame work, which may be analogous to a given solid beam of such a shape as to support the greatest possible weight, when in a horizontal position: assuming that figure which will make it equally strong throughout. For such a beam of uniform width that which is semi-eliptical in its longitudinal direction possesses this property: and the invention here claimed consists in arranging a frame work to possess this property of the solid beam; or rather to acquire great depth, and consequently strength of beam, by having the frame so supported by posts and braces as to be firm and unyielding to a weight placed on it; by which can be obtained such strength as will answer for bridges of two or three hundred feet span.

The bridges now in use involving in any degree the principles of this invention are of different kinds; the most common, are a combination of the arch and frame constituting a crooked beam; and a late invention by Lt. Col. S. H. Long, of the United States Engineers, which is a straight beam; the ends and centres being the same in depth. All of the bridges here referred to differ entirely in the arrangement of the timbers and shape, from the invention here claimed and set forth.

The improvement in question consists in the reduction of a framed beam to the most simple and mathematical form, and such that it will contain no superfluous weight of material, and that each timber of the frame shall receive a portion of stress to support any weight placed on the bridge: and further, that this stress shall be in the longitudinal or strongest direction of them, either in thrust or tension.

The form of the framed beam may be an elipse, a segment of a circle, or a triangle. The former is here assumed to explain the principles and mode of construction, which are as follows, and which are to be the same in each of the cases.

The framed beam consists, 1st, of a string piece made of one timber, or if more, they are to be joined with straps of iron so well bolted

through the timber as to make the joint as strong as the other parts of the string. The string extends the whole length of the span.

2nd. A set of posts, at convenient distances apart, are made to rest on the string, and made fast to it by straps of iron passing under it and well bolted to the bottoms of them. They are to be notched at the bottoms on each side, transversewise of the bridge, to receive sills on which the sleepers and flooring are to rest. The tops of the posts are to be furnished with small mortises on either side, the same as the cuts for the sleepers, to receive timbers which are to be supported between them. They are also to be notched under these mortises, on the outer sides from the centre, to receive the tops of the braces which are to stiffen and resist the crush of the bridge.

3d. A set of timbers joining the tops of the posts which are held in their places by small tenons and mortises. In the beam, they are to represent the upper edge or last point of fracture in a section.

4th. The braces are a set of timbers placed diagonally between the posts, all inclining inwards. The foot of each brace rests on the string near the bottom of each post, except the centre, and the brace then inclines to the top of the next inner post. It is to be cut with square notches at either end so as to receive any pressure it will bear, and not weaken, too much, the head of the post and the string piece. By these braces any weight placed on the bridge, which comes upon the posts, is distributed throughout the frame. A single-way bridge will require two of these beams, and a double-way, three. The sills, as before stated, are to rest on shoulder notches cut in the posts. They may also be so notched as to allow the two, to each set of posts, to come together and be trenailed, or clamped, tight to the posts. They are also to project over the sides of the bridge far enough to receive braces to stay the posts in their upright position. The posts must also be joined across the bridge at their tops by small timbers, which, with the last named braces, will render the bridge sufficiently stable. The sleepers and planking are to be laid as in ordinary flooring. The bridge should also be furnished with side railings, which may be made as fancy may require.

The material for construction may be wood, or iron, or a combination of the two. The strings may be of iron, and also ties, in opposite diagonals to the braces of iron, may be substituted for the braces. If a chain is used for the strings, an inverted position of the bridge may be assumed, in which the chain becomes the part corresponding with upper timbers in the other case, and a similar reversed position will also take place in the other timbers.

It will be seen that a weight placed on a bridge of this description causes a stress throughout all of its timbers in their strongest directions; thus making it a strong and economical mode of construction. It possesses the great advantage of containing no more material than is directly applied to give strength; as well as its being the most plain work of carpentry. The saving in expense of piers and abutments, not required to resist a thrust, must also be counted a material advantage, especially on soft and mealy soil.

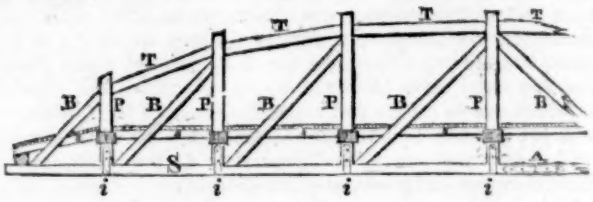
A further benefit claimed in the framed beam, is its use for support-

ing the roofs of houses or public buildings; by which a room of one or two hundred feet can be roofed without other supports than the walls.

A model ten feet long, 18 inches high, of $1\frac{1}{8}$ inch cypress timbers, supported fourteen men, whose weight amounted to 2140 lb.

GEORGE W. LONG.

Fig. 1.



PLAN OF THE ELIPTICAL FRAME BRIDGE.

Explanations of the above plan.

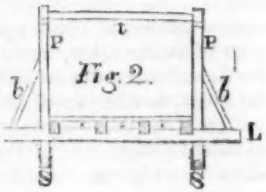


Fig. 2.

Fig. 1 is a side view of the bridge.

Fig. 2 is a vertical section through the centre posts.

S, S, &c. are strings, Figs. 1 and 2.

P, P, &c. are posts, Figs. 1 and 2.

i, *i*, &c. Straps of iron attaching the posts to the strings, Figs. 1 and 2.

B, B, &c. are the main braces, Fig. 1.

T, T, &c. timbers bracing the heads of the posts apart, Fig. 1.

L, the sill of the bridge, Fig. 2.

s, *s*, &c. are the sleepers, Figs. 1 and 2.

F, is the flooring.

A, a joint in the string secured by straps of iron well bolted to the timbers, Fig. 1.

b, *b*, braces. *t* cross piece to steady the frame, Fig. 2.

Specification of a patent for a new and improved Paddle for Propelling Steam and other Vessels. Granted to JACOB PERKINS, Esq. *Civil Engineer: a citizen of the United States, formerly residing in the City of Philadelphia, but now of the City of London, in England, November* 30, 1829.

MY improvement consists in the peculiar arrangement, use, and application of the paddle wheels of vessels, and of the shafts or axles for carrying and moving the same. The shafts or axles are placed as nearly as may be in an horizontal plane, and are so inclined towards each other, and towards a perpendicular plane passing through the keel of the vessel, that if produced backwards, they would meet

in such perpendicular plane, and form with it an angle of 45 degrees, and with each other an angle of 90 degrees, pointing towards the stern of the vessel. The shafts, or axles, being so inclined as aforesaid, pass obliquely forwards through the sides of the vessel, and the wheels being fixed with their planes at right angles to the shafts, look, or stand, obliquely forwards, and outwards, and as a consequence of that position of the axles before mentioned inclined from the sides of the vessel at the places near which they are applied. The floats, or paddles of the wheels, must be so set, or fixed, as that each of them shall stand at an angle of about 45 degrees to the plane of the wheel's motion, to the end and intent that each float, or paddle, when in the lowest part of its rotation, may make a right angle with the keel of the vessel, or act directly in the line of the vessel's way; and the uppermost paddle be parallel to that way, or to the keel. To effect these ends it will be necessary that all the paddles of the upper halves of both the wheels shall have their inner edges pointing backwards, or towards the stern of the vessel, and their outer, or extreme edges, in the direction of the vessel's way, or towards its head. The floats, or paddles, are fixed in the nave, or boss of the wheel, and radiate from its centre.

The practical effect of the above construction will be, that the paddles will enter and leave the water in an oblique direction, and that the lowest paddle will always move in the most advantageous manner for propelling, or backing the vessel, and the uppermost one be in the precise direction of the vessel's way, or parallel to the keel, and will meet with little impediment in its passage through the air, whilst the oblique position of the wheels, with reference to the side of the vessel, will give room for the water to escape. The oblique position of the wheels will increase the width of way required for the vessel, but this inconvenience may be diminished, if not wholly removed, by making the paddles of less width than in common paddle wheels, and by letting parts of the wheels into hollows made for the purpose in the sides of the vessel.

In my arrangement above described, the wheels may be much more deeply immersed in the water than in the ordinary arrangement of paddle wheels, which more than compensates for the loss of power occasioned by narrowing the paddles. In letting the wheels into hollows in the sides of the vessel, the only thing to be attended to is, that the inner edges of the paddles at the lowest point of rotation, must not be within the line of the ship's side at this part, but must be without, and clear of the sides of the vessel. The above description applies to vessels and wheels for sea use, in which case I apply the shafts and wheels one on each side of the vessel, placing them so that a line joining the centres of the wheels, would be in a perpendicular plane, passing through, or as nearly as may be through, or over, the centre of motion of the vessel, in order that the wheels may be removed from the water, or sunk into it as little as possible, by its pitching.

In river and coasting navigation, I use a single wheel formed as above, and fixed upon an oblique shaft passing out from the centre of the stern at an horizontal angle of about 45 degrees with the keel, the paddles being oblique, as above described, or placed at angles of

about 45 degrees with the plane of the wheel's motion, and in such manner that the lowest paddle may always move into a position at right angles with the keel, and, consequently, in that direction which will produce the most powerful action upon the water in the direction of the keel, either for propelling or backing the vessel, while the uppermost paddle will always be parallel to, or in a right line with, the direction of the keel.

The wheel may be made larger when placed in this position than in any other, and may extend so as to cover nearly the whole of the stern, and reach downwards nearly to the bottom of the keel. The position of the shafts, or axles, and the construction of the wheels as above described, are such as I consider the most perfect; but a trifling variation from such position, if rendered necessary by circumstances, will not affect the principle or utility of my said invention.

I am aware that paddles placed obliquely, or at different angles to the plane of the wheel's motion, have been used, and I therefore lay no claim to them, except only so far as they are necessarily used in conjunction with my aforesaid oblique, or angular, shafts, or axles, at the two sides of any vessel as aforesaid, or with a single large wheel fixed astern; and I then only claim them when the said oblique paddles bend, or incline, in the direction before specified; that is to say, with that side of the lowest paddle at right angles, or directly opposed, to the way of the vessel, or nearly so, and with the edge of the uppermost paddle in the direction of that way, or nearly so. When the oblique shaft and large wheel are used at the stern, as aforesaid, two rudders may be adopted, one on each side, or a single rudder at one side only. JACOB PERKINS.

DESCRIPTION OF THE DRAWINGS, PLATE V.

Fig. 1. The wheel as it appears in direct action, when viewing the boat on the beam.

A, the lower paddle, presenting its edge only to the eye, as it then forms a right angle with the keel, and exerts its full action upon the water.

B, the upper paddle, the whole face of which appears, as it stands parallel with the keel.

C, C, the intermediate paddles, the one about entering, and the other having emerged from the water.

Fig. 2. A birds-eye view of the wheel, the letters corresponding with those of Fig. 1.

Fig. 3. D, D, the wheels as fixed about the centre of motion of the vessel.

E, bevelled wheels gearing into each other, and by which the paddle wheels may be driven.

Fig. 4. F, F, the wheels placed in the bows.

G, A single wheel in the stern.

This last is to be considered as two distinct figures, and not as three wheels in one boat.

Remarks by the Editor.—In the number for January, page 42, we inserted some observations on paddle wheels generally, with a parti-

PERKINS PADDLE-WHEEL

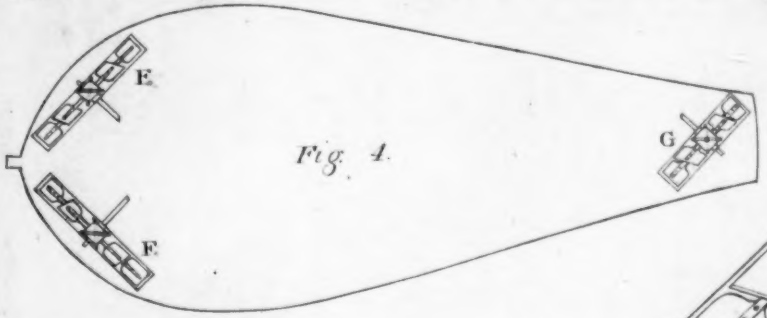


Fig. 4.

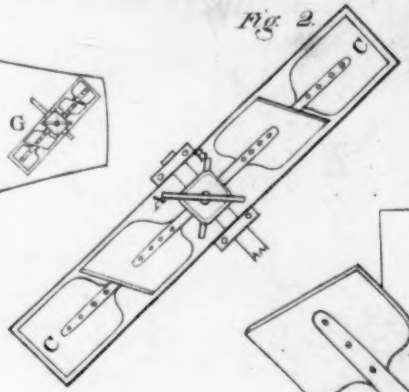


Fig. 2.

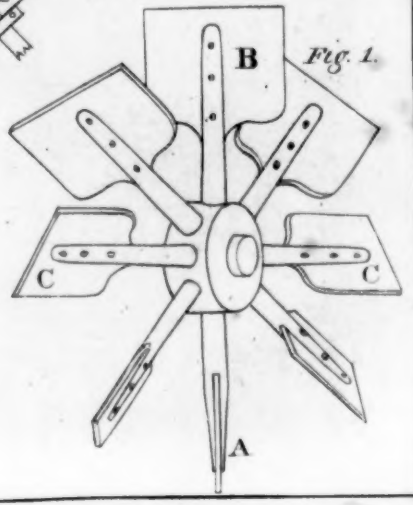


Fig. 1.

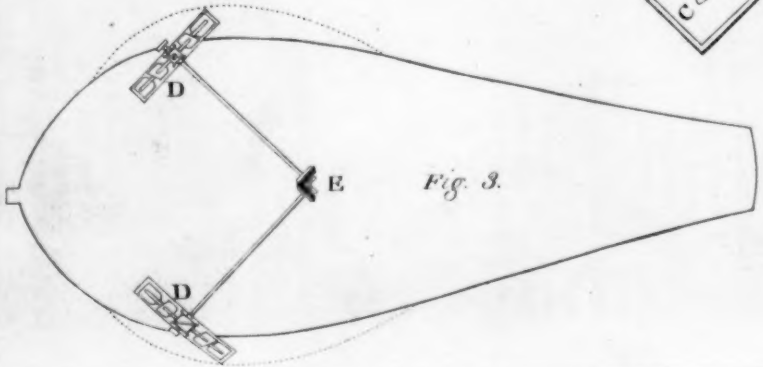


Fig. 3.

cular reference to those described in the foregoing specification; to that article the reader is particularly referred, as its object will be more clearly understood by the aid of the specification and drawings now given. Joseph Hall, Jr. Esq. of Boston, is the proprietor of this wheel, and from him we have expected to receive the result of some further experiments with it; the tardiness of workmen, and those other causes which usually concur in producing days and weeks of delay in such pursuits, have hitherto prevented this; we have determined, however, not any longer to defer the publication of the patent, and to present the expected additional information hereafter.

We believe that there are few persons who would not be posed, for some time at least, if simply informed that a paddle wheel had been constructed in which the buckets were firmly fixed to the axis, there being no revolution, or motion of its parts other than in the ordinary wheel, and yet that every bucket would, in its circuit, assume every possible angle with the keel, or rather with a vertical plane cutting the vessel from stem to stern; yet such is the fact as respects this wheel. Much ingenuity has been displayed in the numerous plans which have been devised for causing paddles to enter and leave the water more advantageously than in the common wheel, but their complexity, and consequent friction, and liability to derangement, have neutralized all the benefits which have been anticipated from them. Should the advantage produced by the present paddle wheel be, in its amount, but one-half equal to the ingenuity manifested in its construction, we think that it will prove to be the best, by far, which has been yet proposed. That we are not apt to be sanguine respecting the success of such projects may be deduced from the tenor of the observations which we have made in relationship to the numerous modes of propelling which have been patented here, and in England; as we have generally thought them inferior to the common wheel; but of Mr. Perkins' we hope better things, and feel a warm interest in the result of a fair experiment. The paddles will certainly enter and leave the water without producing any of that agitation in the boat which is felt from those ordinarily used, and which is only partially corrected by Stevens' divided wheel, an agitation which is equally unpleasant and injurious. A more rapid rotation must be given to this than to the common wheel, as the position of its axis will diminish the lineal velocity of the propelling paddles, in the direction of the boat's way.

There may, probably, be a valid objection to the increased width of the boat, or guards, consequent upon the wheels being placed amidships, as represented in Fig. 3. This, objection, however, will be completely obviated by placing them at the bow, as seen at F, F, Fig. 3, where only half the width of guard will be necessary. A further advantage will result from this arrangement; all the machinery will be brought forward, and a larger clear space left amidships, causing the vessel at the same time to steer with greater facility.

It has by some been apprehended that the oblique action of the buckets as they enter the water would tend to draw the wheel outwards, with a force which it would be difficult to counteract, and

which must produce very great friction on its bearings. This tendency of the dipping, is completely counteracted by the action of the emerging paddles. The truth of this has been proved by Mr. Perkins, in experimenting with a wheel in the stern, as shown at G, Fig. 4. When this wheel was used without a rudder, or any thing to direct the boat but the wheel itself, it was always propelled in the exact line of the keel.

ENGLISH PATENTS.

To JOHN DAVIS, *Sugar Refiner, for a certain improvement in the condenser used with his apparatus for boiling sugar in vacuo.* Dated 2nd October, 1829.*

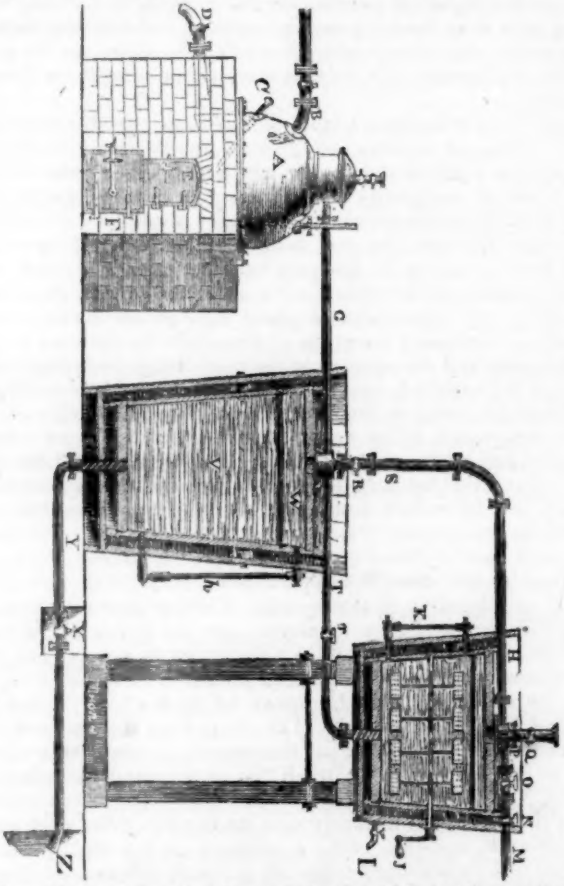
I, the said John Davis, do hereby declare the nature of the said invention to consist, in a certain improvement in the condenser used with the said John Davis's former patent apparatus for boiling sugar, whereby the necessary vacuum is not formed by the admission and eduction of water, as therein described; but by the introduction of steam from the boiler or pan into the condenser, thus doing away with the torrecellian column mentioned in the former patent of the said John Davis. And in further compliance with the said proviso, I, the said John Davis, do hereby describe the manner in which my said invention is to be performed by the following description thereof, reference being had to the drawing annexed, and to the letters marked thereon, (that is to say:)—

Description of the Drawing.

This represents a sugar boiling pan on the former principle, with the said condenser applied thereto, having such portions of the apparatus shown in section, as it was thought would give the clearest explanation of it. A, B, C, D, E, F, are the sugar pan, the feed pipe, proof stick, discharge cock, furnace, ash pit, &c. &c. all of which are too well known to need any further explanation; and G is the pipe which connects the pan with the said condenser, and is in fact, a steam pipe. H is a water tight vat filled with water, for the purpose of keeping the apparatus which is within it always covered with water, and thus air tight. I is a stout cask set into the vat H, with an agitator inside it, which agitator is turned by the handle J working in stuffing boxes to prevent the admission of air. K is a glass tube communicating at each end with the inside of the cask I, through the sides of the vat H, serving as a gauge to show the quantity of water in the cask. L is a discharge cock for the vat. M is a feed pipe supposed to lead from an elevated reservoir of cold water. N is a feed cock to fill the vat. O is a feed cock to fill the cask I through the pipe P,

* This is an improvement upon a plan patented in March, 1828, but the description is so generally repeated in the present specification, as to render the publication of the former unnecessary.—EDITOR.

and Q is an air cock to let the air escape from the cask as it fills. T is a supply pipe leading from the cask I to the condenser V, for the purpose of supplying cold water to the condenser, and R is a stop cock to regulate the supply.



Now this condenser is a large cask set within another cask, the outer cask being filled with water to keep the inner one air tight. W is a shelf of wood or iron perforated with holes to spread the steam when it first rushes into the condenser. U is a stop cock* to cut off the communication between the pan and the condenser. S is a steam pipe, which receives the steam from the pan A through the pipe G. Now this pipe S, it will be seen, communicates at its upper end with the cask, the effect of which is, that when the steam from the pan A is allowed to pass into the pipe G, a portion of the steam passes up the pipe S, and

* This must be in the pipe G, but is not shown in the drawing.

acts on the surface of the water in the cask, thus driving a portion of that water through the pipe T into the condenser, while the other portion of steam passes down into the condenser, and is there condensed by the water that is forced in as aforesaid. Y is a waste pipe leading from the condenser to the reservoir or waste place, Z.

Having now described the various parts of the said apparatus, I shall proceed to describe the manner of using the same, and the mode of creating and keeping up a vacuum therewith, during the process of sugar boiling.

The first thing to be done is, to fill the outer casing of the condenser with cold water, and also the vat H; then stop the cocks N, R, and *r*, and open the cocks O and Q, this will admit water from the elevated reservoir of cold water through the pipe M into the cask, and the pipes S and T, while the air that the water displaces will find vent at the air cock Q; when the cask is completely filled with water, the cocks O, and Q, are to be stopped, and the cock *r* opened, this will cause a portion of the water in the cask, and pipe S, to fall into the condenser, and when it has dropped eight or ten inches, which will be seen by observing the gauge or glass tube K, the cock *r* must be stopped again and the agitator in the cask must be turned round by means of the handle J, in order to disengage whatever portion of air may be in the water in the cask, and which will, by this means, rise to the upper part of the cask; the cocks O and Q must then be opened again, and more water admitted, which will again fill the cask, and expel the air that has been disengaged, by which means, the water in the cask will be as free from any portion of air as possible, and thus fitted for the purpose it is intended to accomplish. The cocks O and Q must now be closed again for the last time during the operation. When in this state, the apparatus is ready for the process of boiling and condensation to commence. The fire must now be lighted in the furnace, the liquor measured into the boiler or pan, and heated in the ordinary way. When the steam in the pan has been got up to a pressure of more than fifteen pounds to the square inch, the water in the condenser must be drawn off by the pipe Y, and the cocks U and X must be opened. The steam from the pan will rush into the condenser and expel what atmospheric air may be in it, and rush out of the waste pipe Y; when this is accomplished, shut the waste cock X, and open the cock R, and partly open the cock *r;* a portion of the steam will instantly rush up the pipe S, into the upper part of the cask, and thus cause a pressure on the surface of the water in the cask, while another portion will rush downwards into the condenser V, striking upon the perforated plate W, and distributing itself for condensation; the cock *r* being partly opened, the effect produced will be as follows,—the force of the steam which is passing up the pipe S into the cask, will act with sufficient force of pressure on the surface of the water in the cask, to force out as much as is required for the purposes of condensation through the pipe T and the cock *r* into the condenser V. which quantity may be regulated by the cock *r;* the cold water thus flowing constantly into the condenser, will condense the steam there, and the condenser must be of a size

to hold all the condensing and condensed water required for one operation, as this operation will continue till the whole of the liquor in the pan is sufficiently evaporated for the purpose of the operator. The general proportions of the apparatus as attached to an ordinary sugar pan, holding about fifty gallons are here shown, but as a useful general guide to the size of the apparatus, it is only necessary to observe, that the cask, should be large enough to hold sufficient water to condense all the steam that will be generated in one operation of the boiling pan, as it cannot be replenished during the process of boiling, and the condenser of the relative size hereinbefore shown. When the operation is concluded, it is hardly necessary to observe, that the water is drawn out of the condenser by the waste pipe Y, and the cask, again filled as before, for the next operation. *h* is merely a gauge to ascertain the quantity of water in the condenser.

Now whereas, I claim only as the invention, the following improvement, viz.—The substitution of the common waste pipe to the bottom of the condenser, instead of the torrecellian column, and an enlargement of the condenser to about six times the size of that required in the said John Davis's former apparatus, by which said improvement I am enabled to form the required vacuum by the introduction of steam from the boiler or pan into the condenser, as hereinbefore described, which does away with the necessity of the torrecellian column, and the consequent height of the apparatus above the well of waste water, which is often extremely difficult to procure, while it greatly simplifies the operation. [*Repertory of Patent Inventions.*

To GEORGE STRATTON, *Gentleman, for his invention of an improvement in Warming and Ventilating Churches, Hot-houses, and other Buildings; which improvement may be applied to other purposes.* Dated August 28, 1828.

I the said George Stratton, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained as follows, (that is to say:)—

My improvements in warming and ventilating churches, hot-houses, and other buildings, consist in the construction of an apparatus having one or more spiral channels, through which atmospheric air is to be passed; these spiral channels being surrounded by a hot medium produced by a close vessel containing steam. The manner in which I construct my improved apparatus is shown in the drawing hereunto annexed, in which Fig. 1 is an external view of the heating apparatus; Fig. 2, is a section of the same taken vertically; and Fig. 3, a horizontal view of the same, the top being removed to show the interior. It is contained in a hollow pedestal, which may be of any convenient form dictated by fancy or taste; that is, circular, triangular, square, or polygonal. The most simple construction of the apparatus is that exhibited by the three first figures, in which the contrivance is adapted to a cylindrical chamber or box: *a a* is the outer case or hollow pe-

destal, enclosing the apparatus; *b b* is a cylinder within the pedestal, having another cylinder *c c* within it, which contains the spiral *d d*. The cylinders *b* and *c* are made of sheet copper, or any other suitable material, and being connected together at top and bottom, and the ends of the passage between them closed, form a close cylindrical box or channel for the reception of steam; a pipe *e*, which communicates with a boiler, conducts the steam into this cylindrical box or channel *b*, by which a heated medium is made to encompass the cylinder *c* containing the spiral *d;* and any water which may accumulate by the partial condensation of the steam, runs off to the boiler or elsewhere by the pipe *f*. In the bottom of the pedestal there is an opening for the admission of atmospheric air, which, passing upwards, proceeds through the winding passage of the spiral, and becoming heated in its progress, is passed off at top into the open part of the pedestal, and thence is disseminated through the ventilator *g*, into the building or apartment intended to be heated. A perpendicular pipe *h*, passes up the centre of the spiral as a support to the several coils of the sheet metal, by which the winding passage is formed. This pipe communicates at top and bottom by means of short horizontal pipes with the steam chamber *b*, and by that means allows the steam to circulate through the centre of the spiral, for the purpose of assisting to heat the air in its progress. The ventilator is formed by two perforated circular plates sliding round upon their centre, or by other sliding apparatus of the same kind, by which the quantity of heated air passed from the apparatus may be regulated.

Fig. 1

Fig. 1

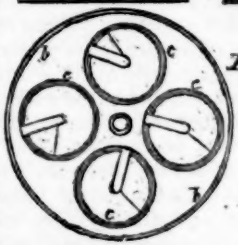


Fig. 4.

Fig. 3

Having described the mode of constructing my improved heating apparatus, in its most simple form, I now proceed to state the manner in which I adapt several of these spirals in one pedestal or steam box, for the purpose of increasing the quantity of air heated, and passed through an apparatus of this description. Fig. 4 is a horizontal section of a circular steam box *b b b*, with four of the cylinders *c c c c* passed through it, each containing one of the spirals *d*, constructed with pipes, and forming spiral channels exactly as described with reference to Figs. 2 and 3. Any number of these spirals may be inserted in this way in a close steam box of any convenient shape; the steam being conducted from a boiler, and admitted by a pipe *i*, in the centre or elsewhere, and the atmospheric air being passed from

below through the spiral channels in the manner before explained, and discharged through a ventilator at top. [*Ib.*

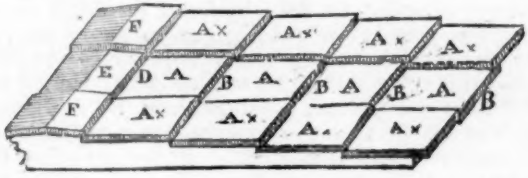
To ELIAS CARTER, *Upholsterer, for a new Covering for the Roofs of Houses, and other Buildings.* Dated October 11, 1827.

I the said Elias Carter, do hereby declare the nature of my said invention to consist in particular shaped plates of iron, or other suitable metal or material to be used in a regular series for covering the roofs of houses and other buildings; and in further compliance with the said proviso, I, the said Elias Carter, do hereby describe the manner in which my said invention is to be performed, by the following description of the said plates, and of the mode of placing the same for the purpose aforesaid, reference being had to the drawing annexed, and to the letters and figures marked thereon, (that is to say:)—And first of the particular shaped plates, which consist of three different forms, and which are shown in the drawings by Figs. 1, 2, and 3. Of these Fig. 1 is what I call the roof plate, and is marked A; it is made with three of its sides turned up and one turned down; the side which is turned down in this figure, is marked B, and I call it, for the sake of distinction, the lip; this roof plate A, tapers narrower towards the lip end of it; by twice the thickness of the plate, the reason for which will be seen when the mode of placing the plates to form a roof is described.

Fig. 1. *Fig.* 2. *Fig.* 3.

To form the ridge of the roof, two kinds of plates are required, and Fig. 2 represents one of these plates, and Fig. 3 the other. The plate, Fig. 2, is marked E, and it will be seen has two sides marked C, C, turned up, and two sides marked D, D, turned down; this plate I call the low ridge plate, and the other plate, Fig. 3, marked F, I call the high ridge plate or cap plate; this plate it will be seen is in fact a mere cap, since all its four sides are turned down; it will be observed that both the ridge plates are made with an angle, sloping downwards each way from the centre; and it should here be observed, that the fall of these ridge plates should not be less than half an inch to a foot.

Fig. 4.



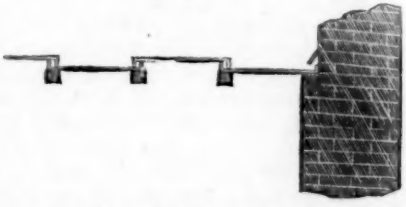
And now I will proceed to describe the manner of laying the said plates to form a roof, with reference to Fig. 4; this figure shows part

of a roof formed of the three kinds of plates hereinbefore described; the plates marked A and A × are all roof plates, those marked A, have the lip B placed downwards, and turned towards the eves of the roof, while those marked A × have the lip placed upwards, and turned towards the ridge of the roof, and it will be observed they are laid in alternate rows; the plates marked A are first laid with the lip B lapping over the upper side of the plate next below it, as here shown, and which the tapering shape of the plates easily permits. The plates marked A × are next laid, a row on each side of the plates A, and lapping over their sides, and then the low ridge plate E, is laid; and last of all the high ridge plate or cap plate F, which completes the portion of roof. It should be observed here, that inasmuch as the high ridge plate F, is to lap over or cover over four edges of other plates, it should be made a little larger in its dimensions than the other plates, while the low ridge plate should, from its situation, be made a little narrower in the direction of the ridge; in fact, it should be of the same width as the roof plate at the lip or smaller end.

Fig. 5.

Fig. 5 is a section across the end of a roof, formed of such plates as aforesaid; and Fig. 6 is a section in the direction from end to end of such a roof, which two last figures clearly show how the sides and lips of the plates are to lap over each other.

Fig. 6.



Now whereas, I do not claim any particular metal or material of which the aforesaid plates are to be made, or any particular dimensions, but I recommend that the plates should be made of cast iron, and that they should be $\frac{3}{16}$ths of an inch in thickness, and two feet square, with the sides and lips two inches deep.

And whereas, I claim as my invention, metal plates so formed, as aforesaid, with such sides and lips as hereinbefore described, and laid in manner aforesaid, for the purpose of forming a covering for the roofs of houses and other buildings; and such my invention, being to the best of my knowledge and belief, entirely new, and never before used within that part of his said majesty's United Kingdom of Great Britain and Ireland, called England, his said dominion of Wales or Town of Berwick-upon-Tweed, nor in any of his said majesty's colonies or plantations abroad; I do hereby declare this to be my specification of the same, and that I do verily believe that this my said specification doth comply in all respects fully, and without reserve or disguise, with the proviso in the said hereinbefore in part

recited letters patent contained, wherefore I hereby claim to maintain exclusive right and privilege to my said invention.

Observations by the Patentee.—The above described roofing is adapted to the covering of churches and other public buildings, as well as private dwellings and warehouses. It is particularly well calculated for the Grecian style of architecture, which requires the roof of a lower angle than can safely be given with any other than a metallic covering. The expense, compared with lead, is scarcely more than one-third.

By the contraction and expansion of metals in all changes of temperature, lead is very liable to fracture, and particularly so when confined, or laid in long sheets. The patent iron roofing being divided into figures of equal dimensions, the expansion or contraction is so equally diffused, and its quantity so divided, that no fracture can possibly happen from such cause. Taking into account the quantity of lead used on slate roofs, upon the ridges and angles, also the charges for laths, copper nails, &c. &c., particularly on buildings of large dimensions, in which the double or M roofs are required; considering also the saving of materials in the diminished surface, occasioned by the low angle, the iron will not be of more cost than a covering of the best slate, over which it has likewise the advantage in being of lighter weight. The slate roof may be calculated to last about fifty years; at the end of that period the old slate will be of no value, although the iron will in that time be scarcely deteriorated, and, in case of the final destruction of a building, the roof covering may be worth the original cost for its original purpose.

The effect produced by the simple and regular form of the parts composing this covering, is peculiarly pleasing to the eye, which is relieved by the light and shade produced by the alternate projection, the apparent thickness, and the gradation of the plates. It also presents a field for the display of architectural taste, in such buildings of classical design, as require that a participation of ornament be continued to the roof; or, that this part of the building be totally concealed from view. The roofing of the portico of the London University may be quoted as a specimen, being made exactly in accordance with one of the best examples of the ancient Greek style, excepting the honeysuckle ornaments of the ridge and eaves, which are omitted.

To illustrate the comparative weights of the different roofing materials generally employed, it may not be deemed irrelevant to the present subject, to give a table of them, as extracted from Tredgold's valuable work on the strength of cast iron.

Copper - - -	100 lbs. per square of 100 feet.	
Lead - - -	800	——
Large Slates -	1,120	——
Ordinary ditto -	900	——
Stone Slate -	2,380	——
Plain Tiles - -	1,780	——

Weight of the proposed iron covering, 1,000 lbs. per square of 100 feet.

An objection having been raised against the cast iron covering on the score of lightning, a few words on that subject may be required:—Electrical experiments prove that metals are all conductors of electricity, the most pure and least oxidable standing first on the list as the best conductors. By this rule iron is not so good a conductor as copper and lead. It is a well known fact that our cathedrals, and many of the older churches, are covered with lead; and buildings without number, in all parts of the world, are covered with lead or copper. The inhabitants of districts where iron is raised and smelted, live without fear amongst immense quantities of that metal; nor is a thunder storm more destructive there than in other places. Iron has likewise been used near a century in the construction of bridges, and neither of them having yet been injured by lightning, is a satisfactory proof that iron is not more attractive of electric matter than any other metal. [*Ib.*

FRANKLIN INSTITUTE.

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall on Thursday evening, April 22, 1830.

Isaac Hays, M. D., was appointed chairman, and

William Hamilton, was appointed secretary pro tem.

The minutes of the last meeting were read and approved.

Mr. S. P. Morris presented to the Institute, *The British Architect, or the Builder's Treasury of Stair-cases*, and also

A German work on Architecture, by Jacob Van Campen, Architect, 1661.

The corresponding secretary laid on the table the following works received in exchange for the Journal of the Institute, viz.

London Journal of Arts and Sciences, for February and March, 1830.

The Mechanic's Magazine, for July, August, September and October, 1829, and January and February, 1830.

The Quarterly Review, Nos. 10, 11, and 12, new series.

The Journal of Arts and Register of Patent Inventions, for August, September, October, November, and December, 1829, and January, February, and March, 1830.

Gill's Technological and Microscopic Repository, for February and March, 1830.

Recueil Industriel, for October and November, 1829.

The North American Review, for April, 1830.

The death of Dr. Godman was announced, whereupon, on motion, it was unanimously

Resolved, that the Institute have heard with extreme regret of the death of their former professor of Natural History, John D. Godman, M. D.

Resolved, that the Institute entertain the highest esteem for the talents, attainments, and character, of Dr. Godman.

Resolved, that the corresponding secretary be instructed to transmit to his family a copy of the foregoing resolutions, and to express to them the sympathy of the Institute for the loss which they have sustained.

Resolved, that the above resolutions be published in the Journal of the Institute, and in the daily papers.

Mr. Charles Potts submitted a paper on "Communicating Heat by Steam," which was read, and on motion, referred to the committee on publications.

ISAAC HAYS, *Chairman.*

WILLIAM HAMILTON, *Recording Secretary, pro tem.*

TO THE FRANKLIN INSTITUTE.

On communicating Heat by Steam; in reply to a query upon that subject in the number of this Journal for March last.

A correspondent in your Journal for March, (p. 216,) under the signature of "Enquirer," proposes a query respecting the heating of water by steam and the solar ray, which, if we mistake not, its purport may be otherwise expressed, as follows.

If by means of steam, the temperature of a given quantity of water is raised from 59° to 120° of Fahrenheit, how high would the same steam have raised the temperature of the water, supposing it to have been heated previously (by the solar ray or otherwise) to 110° of Fahrenheit.

The application of steam for communicating heat to water being extensively used, as in steam engines, brew, wash, and bath houses, dying vats, &c. we hope to be indulged if, in the following solution of the above question, we chance to make a few digressions.

It is known that a quantity of water raised to the boiling point (212°) requires as *much heat to convert it into steam* as would have raised the temperature of the water, *if its volume remained unchanged*, at least 900 degrees higher.

The amount of caloric, therefore, in steam of the same temperature with boiling water, is 212° + 900° = 1112°.

Hence it follows, if a cubic foot of steam at 212° (which is very nearly the product of a cubic inch of water) be compressed into the space of *one cubic inch*, no heat being allowed to escape, its temperature would be increased to 1112°.

Hence also, an equal weight of steam, or water, will impart the same heat, when the temperature of the latter is supposed to be elevated 900° above the former.

In this view of the subject, therefore, we are enabled to reason, from principles relating to the communication of heat between homogeneous bodies.

Let H = the heat required to convert water into steam, or 900°.
h = the temperature of the steam.

S = the weight of steam.
W = the weight of water to be heated.
T = its temperature.
t = the temperature to which it is required to be heated.

As two bodies of the same kind differing only in magnitude and temperature, when brought into contact acquire a common temperature, it must be obvious that when the steam S, has heated the water W, to the temperature t, the quantity of heat which it has lost, or rather imparted to the water, will be indicated by $H + h - t$. For $H + h$, expresses the heat of the steam as it came from the boiler, and t the temperature to which it is reduced after the mixture.

Again, the temperature of the water W, before the steam was admitted into it being T, and after the admission t, the increase of its temperature will be denoted by $t - T$.

Hence we have obviously the following analogy, $H + h - t : t - T :: W : S$, and consequently, $S = \frac{t - T}{H + h - t} W$. This formula which serves to find the quantity of steam necessary to heat a given quantity of water, to a given temperature, expressed in words, will stand as follows.

Multiply the quantity of water to be heated, by the difference of temperature which is to be given to it, and divide the product by the difference between the measure of caloric in the steam, and the temperature it gives to the water.

In illustration of this *rule*, we shall apply it to determine the conditions of the first experiment.

Per query. What quantity of steam, at 212°, will suffice to raise the temperature of 900 cubic feet of water, from 59° to 120° Fah.

Here we have the quantity of water W = 900 cubic feet. Its temperature T = 59°, and the temperature to which it is raised t = 120°.

Again, the temperature of the steam h = 212°. Its measure of caloric will be $H + h$ = 900° + 212° = 1112°. Hence by the *rule* we have the quantity of steam S, equal to $\frac{120° - 59° \times 900°}{1112° - 120°}$ = 55¼ cubic feet of water converted into steam.

The quantity of water necessary to form the steam, it may be observed, will always be of the same name with the water to be heated.

From the foregoing general rule, may be derived the following formulas.

1. To find the quantity of water of a given temperature that will be required to make any given reduction in the temperature of steam, we have, $W = \frac{H + h - t}{t - T} S$.

Example. How much water, at 60°, will be required to condense one cubic foot of steam at 212°?

Here the amount of water in the steam S = 1 cubic inch its temperature, h = 212°, also when condensed t = 212°. The tempera-

ture of the water, T = 60°. Hence the amount of water $W = \frac{900° + 212° - 212°}{212° - 60°} = \frac{900}{152} = 5.9$ cubic inches.

2. To find as above, the temperature, when the quantity of water is given, $T = \frac{(H + h - t)\,S}{W} - t$.

3. The quantities of steam and water being given, to find the temperature of the steam necessary to raise water from one given temperature to another, we have $h = \frac{(t - T) \times W}{S} - H + t$.

Example. What must be the temperature of one cubic foot of steam, to raise one cubic foot of water from 60° to the boiling point (212°.)

Here the quantity of water W = 1 cubic foot, or 1728 cubic inches. The quantity of water formed into steam S = 1 cubic inch, temperature of the water to be heated T = 60°, the temperature to be given to it $t = 212°$. Hence we must have the temperature of the steam, h, equal to $(212° - 60°) \times 1728 - 900° + 212° = 261544°$, which is nearly ten times greater than the temperature of melted iron.

4. When the quantities of water and steam are given with their respective temperatures, to find the temperature resulting from their mixture, we have $t = \frac{(H + h)\,S + TW.}{S + W}$ Or in words, add together the products of the weight of steam by its measure of caloric, and the weight of water by its temperature, and divide by the sum of the weights of water and steam mixed, the quotient will be the temperature required.

Example per query. A vat containing 900 cubic feet of water at 100°, has an equal quantity of steam mixed with it, which in another case raised the temperature of an equal amount of water from 59° to 120°. What will be its effect in this instance?

It has already been shown that $55\frac{1}{3}$ cubic feet of water formed into steam, at 212°, will be required to raise 900 cubic feet of water from 59° to 120°. Hence, the temperature of the steam being the same for the present example, we have the weight of steam = $55\frac{1}{3}$ cubic feet of water, its measure of caloric = 900° + 212° = 1112°. The weight of water = 900 cubic feet, and its temperature 110°, then by the rule, $\frac{1112° \times 55\frac{1}{3} + 110° \times 900}{55\frac{1}{3} + 900} = 168°$ the temperature of the water in the sun's vat after mixture.

When water is employed for communicating heat, before it has received the elastic form, we may compute its effect in either of the preceding cases, by striking out of the formula the term H.

5. The heat required to convert water into steam, or to give to mercury, ether, &c. their elastic form, may readily be determined by the formula $H = \frac{(t - T) \times W}{S} - h + t$. When the weights of the liquid and gaseous masses W and S, their respective tempera-

tures T and *h*, and the temperature *t*, resulting from their mixture, are known.

With respect, yours, &c.

CHARLES POTTS.

Philadelphia, April 2, 1830.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Notice of some errors in Mr. C. POTTS' *paper on Computing the Power of Steam Engines.*

SIR,—In the February number of your Journal, it is stated, by Mr. Potts, that the velocity with which steam, at the temperature of 212°, will rush into a vacuum, is 644 feet per second. Now I find by taking Mr. Potts' estimate of the specific gravity of steam, which I believe to be correct, or nearly so, from the best experiments—that an atmosphere of steam of uniform density must be 64500 feet high to equal a pressure of 30 inches of mercury, and by the laws of falling bodies it may easily be calculated that a body having fallen 64500 feet, will have acquired a velocity of 2000 feet, (in round numbers,) which is the velocity with which steam would rush into a vacuum. 2000 being substituted for 644 in Mr. Potts' calculation, will increase his maximum velocities more than 3 to 1.*

Mr. Potts says, further, "it is established in dynamics, that when the velocity with which any engine works is *one-third* of the *greatest velocity* with which it is capable of working, then will the work done be a *maximum*." This again is incorrect; for though this doctrine is laid down in some of the older books, the fallacy has been pointed out by later writers, and an unexceptionable demonstration given that the maximum velocity is when the machine moves with one-half of the velocity of the impelling force, and not one-third, as assumed by Mr. Potts. [See Edinburgh Encyclopedia, article Mechanics, and 3d vol. of the Transactions of the American Philosophical Society, article by Mr. Waring, also Smeaton, whose experiments demonstrate the same principle.]

If then these principles are applicable at all to steam, Mr. Potts' maximum velocity must be again increased in the ratio of one-half to one-third; and by calculating his maxima with these corrections, it will be found that the piston must move a little more than four and a half times as fast as he has made it. For instance, in the last case calculated by him, instead of 11 feet per second, his piston would have to move with the velocity of 51 feet.

But these principles do not apply to overshot wheels, nor steam

* Since writing the above, I have read a work on Rail-roads, by Thomas Earle, Esq. of this city, just published, which I would recommend to the readers of the Journal, as containing a great deal of information in little space. I perceive the author gives the specific gravity of steam a little greater than Mr. Potts. I have not authorities in my reach at this moment to decide which is right, but in either case the velocity of steam rushing into a vacuum will be more than double what is allowed by Mr. Potts.

engines where the power is caused, not by impulse, but by pressure. In water power it is applicable only to undershot wheels, for in overshot wheels it is equally consonant with theory and experiment, that the slower the motion the better, provided it is equable and uniform. And the same is true of steam engines, though in these last an increase of velocity even to the extent of 20 feet per second would not diminish the power more than one-hundredth of the whole, if the communication between the boiler and the cylinder is as large as it should be. And even where this communication is too small, the loss of power will not be occasioned by the piston's running away from the steam, as Mr. Potts supposes, (for the steam easily keeps up with the piston; even when the communication is stopped;) but by the increased density of the steam near the end of the stroke, as was very clearly shown by "An Old Engineer," in a subsequent number of this Journal.

In Mr. Potts' concluding remarks on this subject, he calculates that if the piston of an engine runs at one time with a velocity of 660 feet per minute, and at another with a velocity of 200 feet, and the piston in the former case has a pressure of 100 lbs. to the inch, and in the latter, of 133 lbs. to the inch; that the effect in the former case will be to the effect in the latter as 66000 is to 26600. This calculation is perfectly just. But Mr. Potts would have us to believe that there is a great loss of power in the latter case, by not attending to the "adjustment of the load," or in other words, his reasoning implies that the same quantity of steam was used in both cases. But this is not the fact: and Mr. Potts will find, by reviewing the subject, that the quantities of steam used in the two cases were in proportion to the work done, or rather there was a slight balance in favour of the slow motion, for it is known that the tension of steam increases in a higher ratio than the density, (which is due to the increase of temperature, 480 degrees giving one atmosphere.) Besides, every person at all conversant with the subject, knows that the higher the temperature at which the steam is used, the sooner it may be cut off, and thus a greater effect obtained by a given quantity of steam. For example, by using steam dense enough to allow its being cut off at one-third of the stroke, just double the power would be obtained by the same quantity of fuel, which would be obtained by using the steam at half the density without cutting it off at all. For the mean density of the steam after it is cut off is one-half, and it operates through twice the space, and a $\frac{1}{2} \times 2 = 1 \times 1$.

As to a loss of power involved in the "crank motion," I entirely agree with what was said by an "Old Engineer" in reply to Mr. Potts.

J. P. ESPY.

On the Explosions of Boilers of Steam Engines. *By* M. ARAGO.

[From the Annuaire du Bureau des Longitudes, 1830.]

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

THE steam engine may be considered as the noblest work of human ingenuity when we shall have succeeded either in preventing

the explosions to which it is liable, or the destruction of property and of human life, which are too frequently the consequence of such accidents. This problem, it must be confessed, has not yet been solved completely, although it has occupied the attention of men skilled in both science and the arts. The ingenious contrivance of Papin, known under the name of the *safety valve*,* is sufficient, it is true, in *common cases*, but there are circumstances, happily not common, in which these valves do not answer the purpose for which they are applied, and are even dangerous. The object of this paper is to point out these circumstances as far as the imperfect state of our knowledge will permit, the causes which lead to them, and the more or less effectual means of avoiding them.

I shall at first set before the reader a brief account of all the explosions which are known to me, and which have been witnessed or described by experienced engineers. In this way we shall be able to examine to advantage the different explanations which have been given of these dreadful accidents.

Examples of the most violent explosions which have taken place up to this time.

At a large distillery, called *Lochrin*, near Edinburgh, the proprietor, with a view to economy, undertook some years since to substitute steam distillation in place of the old mode. Large metallic tubes, through which steam circulated, were made to pass and repass through the vessels containing the liquids to be distilled. The steam was generated in a boiler of forged iron of more than a third of an inch in thickness, 37 feet in length, three feet in width at the bottom, and two feet at the spring of the top, and four feet in height. The weight of this boiler was 18 tons. On the top of this boiler were two safety valves so arranged as to open when the pressure of the steam within the boiler should exceed four atmospheres, or 60 lbs. to the square inch. To guard against any addition of weight by the workmen, one of these valves was inclosed in a grating fastened by a lock.

This immense apparatus was put in operation on the 21st of March, 1814. Twelve days from this time it no longer existed, the whole had been destroyed by an explosion.

In bursting, the boiler was divided into two distinct and unequal parts. The upper portion composed of the cover and the two sides, weighed 14 tons. It was thrown upwards with such force that after penetrating a brick arch and the roofing of the building, it rose to the height of 70 feet. This enormous mass fell at a distance of 150 feet from its former bed, upon one of the buildings of the distillery, passed through it and crushed a large trough of cast iron situated upon the ground floor of the building. Happily but two of the workmen were near the boiler when it burst. These were the only persons killed, although other workmen were in the adjoining buildings,

* This valve, the common safety valve, is described in a subsequent part of this paper.—TRANS.

and the boiler, like the crater of a huge mine, threw in every direction, and with prodigious violence, quantities of tools and fragments. The limbs of one of the workmen killed were separated from the body; it is a remarkable fact that the limbs remained in the distillery while the body was found at a distance out of the building, amidst the fragments.

The line along which the boiler was torn was perfectly horizontal, and followed a row of nails as regularly as if the iron had been cut with strong shears.

The boiler, on the plan of those of Watt, was *convex to the interior*, on the side next the fire, in this way it formed a sort of arch which allowed the flame from the furnace to play in the centre, almost, of the liquid. After the explosion, this side was found to be *convex outwards*, so strong had been the pressure from within. This change of form might have been predicted, but if the examination made after the accident had not proved it, it would have been difficult to believe that the bottom of the boiler of 4 tons in weight, and which bore such evident marks of the enormous *downward* pressure to which it had been subjected, would be *raised* to a height of 14 or 15 feet, and carried to some distance from the mass of masonry upon which it had been placed.

It is important to remark, that no circumstance authorizes the supposition that the accident at Lochrin depended upon the imperfect construction of the safety valves. I have already said that one of them was under lock, so that we cannot suppose an overcharge of the valve.

Second example, characterized by the simultaneous explosion of several boilers.

The steam boat *Rhone*, constructed by Messrs. Aikin and Steel, was intended to ply as a tow-boat between Arles and Lyons. It carried a very large engine, well made at Paris, in the works of la Gare, and fed by four boilers of laminated iron each 52 inches in diameter. Since the accident, it has been found that the metal of the boiler was, in many places, not more than $\frac{1}{4}$ of an inch in thickness.

On the 4th of March, 1827, while preparing for a trial which was to be witnessed by the authorities of Lyons, the boilers burst. Several persons, Mr. Steel among others, were victims of this accident. Some of the spectators on the wharf were killed by splinters from the boat. The whole deck was thrown to a great distance, the braces and the pipes of the chimneys, weighing more than 3 tons, were projected almost vertically to a considerable height; the top of one of the boilers fell 330 yards from the boat; it did not weigh less than 2 tons.

This horrible catastrophe was the inevitable consequence of the imprudence of the engineer. Disappointed in not being able to stem the current with as great rapidity as he had expected, Mr. Steel fastened down the safety valves of the four boilers. This fact, however incredible it may seem, has been proved to be true. We have remarked that there were four boilers in the boat. It is certain that

two of them burst almost at the same instant. If I have been correctly informed, in drawing up from the river a third, not long since, it was found that this also had burst. This bursting of two, and perhaps three boilers, at the same moment of time, is a remarkable fact, and one which will be referred to when we shall speak of the different explanations given of the causes of these accidents.

I ought not to forget to mention that at Lyons, as at Lochrin, the top of the boiler, which was thrown to a distance of 330 yards, had separated from the sides along a line nearly horizontal, although along this line the metal varied in thickness more than 8 hundredths of an inch. M. Tabareau, from whom I have copied these interesting details, has calculated that the additional thickness of 8 hundredths of an inch gave to the thickest parts of the metal an additional resistance of more than 6 atmospheres in 20 or 25, which was the total strength of the boiler. Thus there was a rent made at the same instant in parts of the boiler of which the strength differed six atmospheres at least.

I have just remarked, that the fact of the simultaneous explosion of several boilers placed over different furnaces is worthy of attention. It may be useful to cite another example of the same kind.

At the entrance to the tin mine of Polgooth, there is a large steam engine fed by three separate boilers. This machine having been stopped for a few minutes, to give the engineer an opportunity of repairing the air pump, two of the boilers immediately burst. Captain Reed, who was then near the mine, states that the noise of the first explosion had scarcely ceased when the second was heard.

Explosions caused by overloading the safety valve.

After the explosion which entirely destroyed the sugar refinery in Wellclose Square, London, it was found that the casting of which the boiler was made was not every where of a proper thickness. At the bottom the boiler was not less than 2½ inches thick, on the two vertical faces an inch and a half, in the lower part of the cover seven sixteenths of an inch only, in some other points not more than the eighth of an inch thick.

Some minutes before the accident, an agent of the constructor, disappointed at the want of power of the apparatus, notwithstanding the representations of the workmen of the refinery, had loaded the safety valve with an enormous weight, at the same time urging the fire as much as possible.

We may remark that at London, as well as at Lyons, the boiler burst in places which were so unequal in thickness, that if we represent by unity the force which would burst the thinnest parts, the thickest would resist a tenfold action.

During the inquiry instituted by the house of commons in 1817, into the circumstances of the bursting of a steam boat boiler at Norwich, Mr. William Chapman, a civil engineer of Newcastle, mentioned the bursting of a boiler caused, as in the preceding case, by an overcharge of the safety valve; a workman had seated himself upon the lever of the valve to exhibit to his comrades the see-saw

motion which, he said, would take place as soon as the steam became strong enough to raise him. The valve was not raised, but the boiler burst. The fragments killed and wounded a number of persons.

In America the boiler of a steam boat on the Ohio burst while the crew were getting the boat under weigh, that is to say, when the machinery, not being in motion, no steam was consumed, the fire being raised in the furnace. To prevent accident, the safety valve should have been raised or the weight removed from it; through a strange mistake, the engineer had placed upon it an additional weight.

Explosions preceded by a great decrease in the tension of the steam.

In every case hitherto cited, except that of Lochrin, it has been proved that the safety valve was either completely shut, or loaded too heavily. The causes of these accidents seem evident. We are now about to enter into a detail of facts much less simple. Several of them, it must be confessed, seem at first paradoxical, and inspire doubt, but the examples are numerous, and the authorities on which they rest undoubted. Some minutes before the cast iron boiler of a low pressure engine in the factory of M. Feray, at Essones, burst, on the 8th of February, 1823, the engine supplied by it moved more slowly than usual, so much so that the workmen complained of it. Just before the explosion, the two safety valves had opened and the steam was issuing through them freely.

An accident in every respect similar to that of Essone, took place some days afterwards, on the boulevard of Mount Parnassus, Paris. Here, as at the factory of M. Feray, the workmen complained that the slow rate of the engine would enable them to accomplish but little work during the day, when suddenly the boiler, which was supposed to be nearly void of steam, burst. This boiler was of rolled copper. Nothing induced the suspicion that the safety valve was not in good condition, on the contrary, there is every reason to suppose that a free escape of steam preceded the explosion.

When the boiler of the steam boat Etna (America) burst, the piston was making but eighteen strokes in a minute. Usually the number of strokes was twenty to the minute, thus the boiler burst under the pressure of a vapour sensibly less elastic than that which it usually contained.

On the day of the explosion in the steam boat Rapid, at Rochefort, the gauge had often indicated that the steam in the boiler would support 12 inches of mercury more than the atmospheric pressure; some minutes before the accident the gauge was at the height of only 6 inches.

The inquiry in relation to the explosion on board the steam boat Graham, showed that just before the accident, a weight of twenty pounds had been taken from the safety valve.

Explosions immediately preceded by the opening of the safety valve.

I will first observe that the bursting of the boiler at Essone might

have been placed under this head, for the safety valve opened just before the explosion.

A low pressure boiler in a workshop at Lyons, burst immediately after a large aperture had been opened, by turning a cock, through which the steam began to issue with rapidity. To open this aperture was equivalent to raising the safety valve: here then an explosion was attendant on the very means which would seem most proper to prevent such an accident.

This fact, however strange it may appear, will be received without scruple, when I state that it is given by M. Gensoul, of Lyons, and further, that this skilful engineer witnessed the circumstance.

If, in an extreme case, the opening of a safety valve may occasion the bursting of a boiler, it must frequently happen that though no such effect should be produced by opening it, yet there may be produced a sensible and sudden increase in the elasticity of the steam; the action can within such limits be observed without danger. Such an experiment was made at Lyons upon a small high pressure boiler, and as soon as a large aperture for the escape of steam was made, by turning a cock, the safety valve was forced open. A contrary effect was observed by M. Dulong and me at Paris, we always found a diminution in the tension of the steam caused by opening a valve; the experiment at Lyons is not the less certain, however, since it rests upon the authority of M. Sabareau, director of the school of la Martiniere, and of M. Rey, professor of chemistry. The probable causes of this disagreement which I shall explain hereafter, will show how the particular kind of accidents recorded in this article may be prevented.

Rending of boilers by a pressure from without.

Boilers constructed of plates of laminated copper or iron, low pressure boilers particularly, are subject under certain circumstances to accidents exactly the inverse of those which we have been engaged in describing.

These boilers are sometimes completely crushed, the sides bending to the pressure from without. Lyons and St. Etienne have been the theatres of several accidents of this kind, which should be guarded against if it were only to prevent whole factories from being reduced suddenly to a state of inaction.

The inner cylinders of boilers having the furnace and flues within, give way occasionally. They are unable sometimes to resist the pressure of the steam in the annular space around them, lose their shape, becoming flattened: this change of figure cannot take place without the metal giving way, and hot water thus escaping into adjacent rooms, produces dreadful havoc. I shall quote an example of this sort from Mr. John Taylor, fellow of the Royal Society, London.

At the Mold Mines, in Flintshire, there is a large steam engine supplied by three boilers with interior flues. The machine was once stopped for five minutes; the engineer had raised the doors of the three furnaces and closed the registers in two of the flues; just as he closed the register of the third flue, he saw a burst of flame from

the furnace into the room, and an explosion immediately followed. Two workmen who were in the direction in which the boiling water escaped, were killed instantly. A careful examination of the boiler showed that the exterior cylinder had not moved, nor had it suffered the slightest injury. The weight attached to the safety valve was also in its place after the accident. The interior cylinder had not moved from its place, as it sometimes does in this sort of explosion, but it was so flattened throughout the greater part of its length by the yielding of the lateral faces, that there was scarcely room to introduce the hand between them.

It may appear at first sight strange that I have placed an explosion proceeding from the too great elasticity of the steam within the boiler, in the same class with the inverse accidents described in the preceding paragraph, but it will be seen that these two effects have, to all appearance, a common cause.

Accidents peculiar to boilers with interior flues.

However little we may have studied the many causes of the explosions of steam boilers, and the varied combinations of them which are possible, we must have seen that to attempt to reduce them to fixed rules, would be out of the question. We may remark, however, that the form of the boiler is a prevailing cause, and determines the nature of the fracture. In this point of view, particularly, detailed and complete tables of the accidents of daily occurrence would be very useful. It appears from the tables published about two years since, by Mr. John Taylor, that in boilers of concentric cylinders, or with interior flues, the faces of the interior cylinder are the weak parts. After the almost simultaneous explosion of the two boilers at the Polgooth tin mine, the interior cylinders of both boilers were found to have been twisted and rent in many places.

At the East-Crennis mine the interior cylinder was not only flattened by the crushing together of the upper and lower faces, but the cylinder was thrown with great force out of the building without the exterior cylinder having been moved, or having been badly rent. The preceding article contained a more striking example of the change of figure and rending of the interior flue* without injury to the exterior cylinder of the boiler.

Explosion preceded by the boiler becoming too highly heated.

Too high a heat communicated to that part of the boiler which contains the steam may give rise to accidents. An example of this may be taken from an explosion which occurred at a foundry in Pittsburgh, America.

* Popularly termed "the collapsing of the main flue." Such accidents are not uncommon in the high pressure boilers of the boats upon our western waters, usually of this construction. In the late accident on the Hudson, the interior flue gave way, allowing the boiling water to be pressed against the false front of the boiler, which was incapable of resisting violence.—TRANS.

In this establishment a high pressure engine of eighty horse power was supplied by three separate cylindrical boilers, each being 30 inches in diameter, and 18 feet in length. It had been observed for some time, that owing to a defect in the pipe from the pump which supplied the boilers with water, one of them did not receive a sufficient supply, and became red hot, but as the two others furnished enough steam, they thought that it was unnecessary to repair the feeding pipe. This boiler receiving an insufficient supply of water, burst, the greater portion separated from one of the ends was projected under an angle of 45°, burst through the roof of the building, and fell about 600 feet from it.

Explosion of a boiler in the air.

We have rarely precise details of the circumstances accompanying the bursting of a boiler, either because the accidents have happened unexpectedly, and scarcely last some tenths of a second, or that those who have witnessed them have been victims to the accident. An attentive examination of local circumstances, of the mass remaining, of the fragments thrown from it, their distances, &c. will often serve to show what part of the boiler yielded first, and with what velocity the fragments have been thrown: usually our information stops here. It is of all importance then, to collect carefully every thing which chance may throw in our way in relation to accidents so dangerous and so worthy of study. I therefore hasten to extract from a letter of Mr. Perkins, the following facts, which will not appear devoid of interest.

An explosion came to my knowledge, says this skilful engineer, which was preceded by a rent through which the steam escaped with great velocity. Notwithstanding this unexpected safety valve, the boiler was separated from the masonry upon which it was placed, was projected entire to some feet above the ground, and in the air the explosion took place which burst it in two. The upper half rose very high, the lower fell to the ground with great noise.

I am much mistaken if the same circumstances did not attend the Lochrin explosion.

It remains for us to ascertain from the preceding facts what the different causes are which have produced so many accidents, and the means of preventing their recurrence.

Necessity of providing safety valves: safety valve of Papin, its defects, accidents which such valves may prevent.

Florence Rivault, Solomon de Caus, and the Marquis of Worcester, had already remarked in 1605, 1615, and 1663, (as may be seen in our first article, Annuaire for 1829,) that a vessel, however strong its sides might be, containing water, if placed over a fire, would burst unless an opening was provided for the escape of the steam as fast as produced. The fatal experiment of Mr. Steel at Lyons, has too certainly shown the truth of this opinion. The temperature which will cause the rending of a vessel must depend upon its form

and dimensions, and upon the tenacity and thickness of the material of which it is made. If we were sure that the heat of our furnaces could be kept below a certain limit determined beforehand, no further precaution would be necessary than to effect this; but after observing, even but for once, the manner of supplying an ordinary furnace with fuel, how much the combustion depends not only upon the nature of the fuel, upon its size, upon the manner of placing it upon the grate, not to speak of the influence of the state of the atmosphere, we should immediately resign the idea of deriving from the furnace means of preventing explosions.

We must then begin by supposing that a boiler entirely closed, and not of an enormous thickness, (there being more than one difficulty to be overcome before we can exceed certain limits in this particular) may contain, at times, steam of an elasticity greater than can be borne by the resistance of the faces. But to prevent this from happening is the only mode of preventing an explosion.

The safety valve invented by Papin seems to cut short all difficulty.

This safety valve consists of a hole, say of an inch square, made in the upper part of the boiler, upon which is placed a metal plate loaded with a certain weight. It is evident that the hole will remain closed as long as the pressure of the steam within the boiler is less than the weight of the valve, together with that of the atmosphere, upon the square inch, and that as soon as the pressure within shall exceed this, the valve will be raised and will give a free vent to the steam.

Let us now endeavour to ascertain how it may happen that so simple, so apparently reasonable a means, and one so easily executed, may not prove always efficacious.

The plate forming the valve rises the instant the weight with which it is loaded is exceeded by the pressure of the steam within the boiler, but to prevent any increase of elasticity in the steam within, this valve must further be of sufficient size to give vent to all the surplus steam. The escape of steam depends upon the diameter of the opening, and an opening which may be sufficient for ordinary occasions, may be much too small when accident causes the sudden conversion of a great quantity of water into steam. In such a case the valve may diminish the evil, but cannot prevent it. If the difficulties of adjustment, and the enormous weights, required did not set limits to the size of the opening, there would be a great advantage in using safety valves of very large openings. Without going too far, we may, I think, admit that hitherto we have used valves of too small a size. The justness of this assertion will not be doubted, especially if we recollect the curious observations recently made upon the flow of fluids through small apertures. It has been found that a light disk brought perpendicularly opposite to a current of steam flowing from an aperture made in a high pressure boiler, is not always repelled. At a short distance from the opening, the plate, which is urged by two opposite forces, the steam which tends to drive it from the aperture, and the pressure of the atmosphere acting towards it, remains, in consequence of the equilibrium of these two

forces, suspended without motion. I cannot here examine how it happens that the steam loses in the very act of issuing, so great a part of its strength, that the pressure of the atmosphere counterbalances the remainder; I shall content myself with stating the fact that the plate is removed but a short distance from the aperture; the same thing will happen with the disk of the safety valve, and thus when it is raised, much less steam will issue than was calculated by assuming the vent to be of the size of the aperture closed by the valve.

M. Clement, who has studied these facts with great care, saw in them grounds for condemning the safety valve with a moveable disk. This opinion goes perhaps too far, but it is certain that the partial rise of the valve offers an additional difficulty to be obviated by machineists, and the imperfect construction of the valve may sometimes be one among the causes of explosion.

Let us pass to difficulties of another kind.

In France the law requires that every cast iron boiler before it can be used must have borne an interior pressure of five times the amount of the pressure under which it is to be used, and this pressure is reduced from five times to three times for boilers of rolled or hammered iron. These limits seem great, and often excite complaints on the part of machineists; we shall see, however, that they are far from affording entire security.

The boilers are proved at ordinary temperatures, at which the metals have a greater tenacity than when heated. As they approach a white heat, the diminution in tenacity is enormous. The experiments of M. Tremery, for example, have proved that the tenacity of forged iron at a dull red heat is but one-sixth part of that of the same metal when cold. If then, by mishap, any part of the boiler should become red hot, the metal would be near the point of rupture, *without the safety valve being raised*, although from experiments made upon the boiler when cold, we should have a right to believe it far from that point.

But why, it may be said, not make a decisive experiment? why not place the boiler exactly in the circumstances under which it is to be used; why, in a word, not substitute steam for water in proving it? The answer is, that by the aid of a pump the boiler may be proved any where, even in the workshop of the person who made it, with but little apparatus, and at a slight cost; whilst to prove it by steam would, on the contrary, require the building of a furnace for every boiler, and a large place for the purpose; we paralyze the arts when we surround them with such trammels. Add to this that the experimenters using the pump run little or no danger even when the boiler gives way, but that this would not be the case were the trial made by steam. The precautions which it would be necessary to take in this latter case to secure the experimenters from danger would add much to the difficulty and expense of this preparatory trial. It seems then that the trial by the pressure of water, notwithstanding the defects which I have already mentioned, and those which yet remain to be explained, will continue to be used.

When we act upon the faces of a boiler by a forcing pump, the interior pressure is increased very gradually: this trial gives us no information in relation to the resistance of these faces to a considerable pressure suddenly applied, but to these abrupt changes of pressure it may be exposed in practice.

Further we may remark, that these trials made upon a new boiler show what it can bear when new, not what it will be able to sustain after some weeks or some months use, after inequalities of temperature have strained the metal in every direction, and disunited its fibres, after rust has acted upon it, &c. &c.

To recapitulate, we have found that notwithstanding the proper construction and good condition of a safety valve, a boiler may explode: 1st. Because the opening of the safety valve is not sufficient to give vent to the steam which is generated suddenly, and in great quantity.

2nd. Because the boiler has been proved when cold, and when heated, particularly when it reaches a high temperature, the tenacity of the metal is much lessened.

3d. Because an *abrupt* increase of pressure may occasion rupture in cases where a greater pressure produced gradually had been attended by no evil consequences.

4th. Lastly, because the boiler is injured by exposure to the fire, and after a few months the tenacity of the metal composing it is often much diminished.

A safety valve, however well constructed, can never warrant the engineer in neglecting to prove his boiler from time to time, nor can it warrant him in not endeavouring to prevent by all the means in his power abrupt changes in the elasticity of the steam, and in not preventing the boiler from, at any time, being too strongly heated.

I have supposed, hitherto, the safety valve in good order; in fact it would seem, at first, difficult for so simple a contrivance to get out of order; but when we consider that the moveable disk often rusts, and that it acquires in consequence of this action, particularly when at rest, a strong adhesion to the metal upon which it rests, we can see that it may not move under pressures much above those fixed upon to be attended with the escape of steam. Mr. Maudslay, whose skill and experience are well known, said that a safety valve no longer deserved its name when it had been left without being moved for a week; he placed near some of his boilers a cord within reach of the fireman, by which he could raise the safety valve from time to time. It has been contrived to produce such a motion by means of levers worked by the machinery, but when the boiler is not near to the working parts of the engine this is not practicable.

The firemen are generally ordinary labourers without prudence, who too often overload the safety valves either to quicken the working of the engine, or to make a parade of their courage. This danger may be avoided, perhaps the greatest danger which is to be feared, by having always two safety valves to every boiler, the one under the control of the fireman to be used whenever the steam is to be let off, the other to be inclosed by a grated box, of which the

engineer, or the proprietor of the engine, should have the key. The use of two safety valves was recommended almost unanimously by a number of engineers examined before a committee of the house of commons in 1817; in France, a royal ordinance makes this precaution absolutely essential. Perhaps it would be well to require that each boiler should be provided with some simple contrivance conveniently placed, by which the fireman could ascertain from time to time that the disk of the valve moved freely: those who are used to visiting workshops know that workmen are with difficulty induced to perform those operations which leave no mark of their performance, unless they can be done easily.

Plates of fusible metal.

As soon as it was found that the common safety valve sometimes got out of order and did not present a certainty of security, it was proposed to replace them by an entirely different contrivance, the action of which should never be uncertain. This was the fusible metal valve, already described in the Annuaire for 1829.

To understand rightly the use of these valves, we should know that it is possible that steam should have a very high temperature and but little elasticity, but not possible that a great degree of elasticity should not be accompanied by a high temperature.

Experimenters have determined the lowest temperature necessary for steam to acquire a tension of one, two, three, ten, &c. atmospheres. By using these results we can know what temperature the steam must not surpass after we have fixed upon the pressure. If we then cover an opening in the boiler with a plate made of an alloy of lead, tin, and bismuth, in proportions such that the alloy will melt at the limit of temperature fixed upon beforehand, this temperature can never be exceeded, for on reaching it the plate melts and gives vent to the steam.

In France a royal ordinance requires that every boiler shall be provided with two fusible plates of unequal sizes. The fusing point of the smaller is 10° (18° Fah.) above the temperature of steam having an elasticity equal to that which the steam to be used in the engine should have. The second plate fuses at 10° (18° Fah.) above the first.

Although many cases may be cited in which fusible plates have probably prevented explosions, they are employed unwillingly by most, preference being given to the common valves, with which, in addition to the plates, the boilers must be provided. Let us then examine the objections to these plates.

It was said at first that since these plates were affected by temperature, and not by pressure, they might melt when the steam within was very hot, but not elastic in proportion, but this can only happen when the vapour is not saturated with moisture, that is, only when there is not a sufficient supply of water within the boiler, then a portion of the boiler must become heated, perhaps even to redness, and then there is imminent danger of an explosion; this first objection seems, therefore, to be refuted.

The plate does not approach the point of fusion without being softened, it is therefore to be feared that it may give way under a tension much less than that which would produce its fusion. At the outset this actually did take place, but the difficulty has been obviated by covering the plate with a wire gauze, with small meshes, before it is fixed by bolts to the aperture which it is to close. Even now parts of the plate yield partially, swelling out in different places as the fusing point approaches, but experience has shown that it is only very near to this point that the metal yields entirely, opening a free passage to the steam.

When the fusible plate has been melted, all the steam escapes through the opening which it closed. It may take some time to replace it, to fill anew the boiler, and to heat the water, and during this time the engine stands still. In a steam boat, in certain cases, this sudden absence of the moving power might occasion serious accidents. This is a real and a great difficulty, and perhaps is the reason why our neighbours have not adopted the fusible metal valve, but give preference to the ordinary safety valve. These, it is true, never suffer all the steam to escape. If they open, it is only when the elasticity of the steam within has passed a certain limit; as soon as this elasticity has returned within this limit, fixed by the engineer beforehand, they fall, closing the aperture; thus the moving power can never fail entirely.

The advocates of the fusible metal plates considered as one of the highest advantages of these valves the physical impossibility of changing their limit of action, thus placing them beyond the reach of imprudent workmen. It is true that with these plates all overcharge, in the literal meaning of the word, would be useless, but when the firemen wish to urge their fires more than usual, they understand how to prevent the fusion of the plate, by directing a constant stream of cold water upon it, so that in this point of view perhaps we have gained nothing.

Thin plates.

A safety valve is in fact nothing but an artificial weakening of a certain part of the boiler. It has been proposed to weaken the boiler by covering small holes, made for the purpose, with laminated plates of metal, of which the thickness should be calculated so that they should burst under pressures of one, two, three, ten, &c. atmospheres, according as we should have determined not to exceed two, three, four, eleven, &c. atmospheres in the pressure of the steam within the boiler. It is evident that the bursting of so small and so thin a plate would never cause any serious accident.

This mode, however specious it may appear, has rarely been used, either because it is not easy to dertermine experimentally the thickness of the plate which for a given size of aperture would burst under a given pressure, or because we cannot be certain of having plates identical in strength. The thin plate is more out of the power of the workmen when in place, than the fusible metal valve, it may, it is true, be weakened, but can never be strengthened, and this is the im-

portant point. In this point of view the thin plates are to be preferred to the fusible metal disks, they have an inconvenience common to the latter, namely, that of suffering the escape of all the steam when they have given way.

Gauge valve.

The gauge tube (a syphon tube the shorter leg communicating with the boiler, while the longer open at the end contains a column of mercury) spoken of before (Annuaire, 1829,) may be made to perform the office of a safety valve, and it answers the purpose better than either the common valve or the fusible plate. The common valve shows nothing of the pressure within until it rises, the fusible plate shows nothing until it melts. The fireman learns suddenly that he has reached the limit which he must not go beyond, but he was not warned of his approach to it. The gauge, on the contrary, gives him every moment the measure of the elasticity of the steam; it indicates low as well as high pressures.

The disk of the common safety valve may have lost its power of moving without the fact being known, whilst, on the contrary, if impurities should stop the gauge tube, the want of motion in the mercury would show it immediately: it is plain that in so large an apparatus as a boiler, and from which the steam does not escape constantly, but at short intervals, the elasticity cannot be constant; the boiler and gauge tube communicating, every fluctuation in the steam produces an oscillation in the mercury of the gauge.

The mercurial gauge should then be considered as the best safety valve yet invented, provided its diameter is sufficiently great. Whenever its too great length does not render it inapplicable, it may be considered as a safe-guard in cases where the best constructed common safety valve or the fusible metal plate would have proved a protection against accident. The reader will see the reason for this restriction, when I shall have shown that there are cases in which the opening of the valve may cause an explosion.

Internal, or air valves: their object.

At the time of lighting the fire under a boiler, the space within the boiler, not occupied by water, is filled with atmospheric air. This air, mixed with steam, passes by degrees into the engine fed by the boiler, and at last is completely expelled therefrom. Things being in this state, suppose the working of the machine to be stopped, and the fire suffered to go down, the steam will be gradually condensed as the cooling proceeds, and after some time the space which it once occupied will be almost void. The boiler is then pressed inwards by the pressure of the atmosphere, without there being any interior pressure to counterbalance the action. When the condensation of the steam takes place slowly, it ought not to cause accidents, since the weakest boilers should have been proved under a pressure, directed from within outwards it is true, of not less than five atmospheres. The consequences might be serious, however, if the con-

densation were sudden; for example, if a jet of cold water should play into the steam; then, in an instant of time, the pressure of the atmosphere ceasing to be counterbalanced, would produce the effect of a percussive force upon the whole surface of the boiler, and would crush the boiler in the way already spoken of in relation to the interior flue of certain kinds of boilers. To prevent such accidents, interior valves, called also air valves, were invented. This valve opens inwards. It is kept in its place by a spiral spring within the boiler, the strength of the spring being a little more than equal to the weight of the valve. Or else it is suspended horizontally to the arm of a lever placed on the outside of the boiler, so arranged that the valve exactly touches the interior face of the opening, which it is to close. With this arrangement the elasticity of the steam within the boiler can never become less than that of the atmosphere without the immediate opening of the valve, which will admit air into the boiler, thus when the engine is stopped, having performed its task, there can be no fear that a vacuum will be formed within the boiler. It seems to me that we cannot so safely conclude that the same arrangement would prevent, certainly, the crushing of the boiler, for such accidents result from a great and abrupt diminution of elasticity in the steam. The gradual action of a valve might, to a certain extent, lessen the evil, but could not prevent it. There is but one remedy against such accidents, to watch carefully the means of feeding the boiler, and to prevent the reservoir of steam within the boiler from being suddenly cooled, as would happen, for example, if a quantity of cold water should be thrown upon the exterior. The crushing of the flues within certain boilers would be easily explained if we could prove that sometimes a vacuum is suddenly formed in the smaller cylinder, but as this cylinder does not contain steam, as it forms only the furnace and its flue, we should have had, perhaps, some difficulty in finding how a vacuum could be produced, if the circumstances of the explosion at the Mold mines had not led us to it.

We must recollect that at the time of that accident the door of the furnace was open, while the register of the chimney was closed, that after closing this register a burst of flame issued from the furnace into the room, and the explosion immediately followed.

With the door of the furnace open the combustion could hardly have been active, and the current of air which rose through the chimney could scarcely have been chemically changed. When the register was closed the air no longer flowed in, but that which the chimney already contained remained there shut up. The coal in the furnace was not yet extinguished, the gas which it contained continued to be disengaged, and to mix with the air of the chimney, its proportion soon became sufficient to render the mixture inflammable; it inflamed, escaped in this state through the only vent which remained, namely the door of the furnace, in an instant the small cylinder was, if not entirely void, as the cylinder in Brown's vacuum engine are after a similar inflammation, filled with a gas highly rarified.

I am much mistaken if this explanation, by Mr. John Taylor, does

not give the true key to the frequent crushing of the small cylinders of boilers with interior cylinders. It is important, therefore, when we use that kind of boiler, not to close the register doors until the coal is extinguished. Paltry considerations of economy cannot have weight where there is so evident a danger, and this danger cannot be prevented by interior valves.*

[TO BE CONTINUED.]

Account of the present state of Manufactures in the Netherlands.

[From the Foreign Quarterly Review, for February, 1830.]

WHEN a flourishing agriculture is once established in a country, as is unquestionably the case in the Netherlands, it is commonly a mainspring of prosperity to the manufacturers, who, in their turn, by increasing the size of towns, and the demand for agricultural produce, give an increased activity to the interchange of commodities. Hence, in the natural course of things, manufactures will appear in their proper season without any such interference in the way of protection as most European governments, and latterly the United States of America, have thought fit to bestow upon them. Upon this protecting principle the Netherlands are also acting in a great degree, though the commercial interests of Holland have been the means of infusing into their tariff a much greater portion of liberality than is observable in that of their neighbours. The government displays a very lively sense of the importance of the manufacturing industry, and among other means of furthering it, has adopted that of periodical exhibitions, the first of which took place at Ghent, in 1820, the second at Haarlem, in 1825, and the third will be held at Brussels during the present year (1830.) We have before us the particulars of the articles exhibited at the first two collections, and though they are far from representing the industry of the kingdom as they ought to do, they are nevertheless good guides to the progress the manufacturers are making in the various provinces. A nation like Great Britain, the pillars of whose arch of dominion are made of cotton and hardware, is most closely concerned in the real state of these matters.

The Metallurgic Arts are in considerable activity in the provinces of Liege, Namur, Hainault, and Luxemburg, where there are mines of iron, lead, copper, and coal. The immense establishment of Mr.

* These remarks are applied to a case in which bituminous coal was the fuel. They would apply equally well to all cases in which the fuel yields a combustible gas, as, for example, to pine wood during the first period of its combustion, to rosin, wet charcoal, &c.

An explosion was produced in a common close stove, in this city, by covering a fire of anthracite with wet ashes; on relighting the fire with shavings and charcoal the following morning, an explosion took place in a drum connected with the stove, and placed in the second story of the house, of which the stove occupied the ground floor: part of the drum was thrown with violence against the ceiling of the room.—TRANS.

Cockrill, at Seraing, near Liege, for machinery of all kinds, is one of the most perfect in Europe, and is a striking instance of the wealth that may be acquired by unremitting industry, the original proprietor having left England almost in a state of destitution. The factories and forges of M. Dupont, at Fuyt, near Binche, and at Arquennes, are distinguished for bar iron, made by a high pressure steam engine, for round and sheet iron, and for axletrees and nails. M. Hanonnet-Gendarme, of Couvin, in Namur, is celebrated for the strength and ductility of his iron, which is said to be equal to Swedish. M. Houyoux, of Bousval, M. de Paul-Barchifontaine, of Sobre-St. Gerey, and M. Silez, of Celestin, in Hainault, work iron in the most superior manner into machinery and implements of all kinds. Articles of steel, copper, and bronze, are executed throughout Hainault and Namur; and as an instance of the tendency of useful inventions to diffuse themselves, the safety lamp of sir Humphrey Davy is now made in the village of Dour, near Charleroi. The cutlery of Arnould-Raymond, and of Laderier, at Namur, is excellent, and prices have been so much reduced that a successful competition with that of Sheffield is confidently anticipated. The hardware of Dupont, François, Simon, Warnaut, and others at Liege, is of the best quality; and the files of M. Raunet, of that city, received a gold medal at the Ghent exhibition, and were pronounced to surpass in quality those of England. It would be fatiguing to enumerate the variety of metallurgic operations going on in the coal provinces, and the multitude of productions, from the smelted iron as it comes from the furnaces, to the needles and bodkins that fill the shops. It is, of course, by this industry that the inhabitants mainly live, and how comfortably they do so in some instances, may be judged of by a visit to the collieries and works of M. de Gorges, at Hornues, near Mons, who has recovered these mines, by draining, from the effects of an inundation—has fixed engines and pumps of 500 horse power—has opened ten fosses—and extracts from them daily 13,000 hectolitres of coal. M. de Gorges employs 2,000 workmen, for whom he has built a handsome town, consisting of 260 neat houses with a garden to each. The rent is from one to two francs per week, according to their size; a very small deduction from the emoluments of men whose wages are from seventy centimes to three francs a day. The streets are laid out with uniformity, and well paved; and in the centre of the village is a large square planted with trees, in which is the ball room for the Sunday amusements, the town hall, and the school of mutual instruction, where 400 children are gratuitously educated. The workmen have the gratuitous use of store houses for all purposes, and of the luxury of baths; and appear altogether in a very happy condition, and comfortable. The benefits which a great capitalist has it in his power to confer, were never more strikingly exemplified than by M. de Gorges's village of Hornues, and we have not thought it inappropriate to mention it specially, because such examples are not only useful, but cheering, amidst the mass of misery with which every nation more or less abounds.

The quantity of coals annually dug in the Netherlands may be taken at about 60,000,000 metrical quintals of 100 kilograms each, the value of which at forty centimes the quintal is 24,000,000 francs (£960,000.) There were in 1822, in the four provinces we have mentioned, 93 great furnaces, 206 forges, 68 martinet houses (for hammering,) 19 foundries, 17 laminoirs or rolling houses, and 12 tin factories. Estimating the rough iron produced at 500,000 quintals, and the font or cast iron at 100,000 quintals, and valuing the wrought iron at 20, and the cast iron at 6 francs the quintal, we shall have a total value of 10,600,000 francs, (£424,000,) which we believe to be much under the mark, though from the depression complained of a little time back, we are fearful of overrating the quantity produced.

The fabrics of cloth and casimir are some of the most important, having a considerable sale not only in the kingdom, but in the North of Europe, and America. The principal seat of this industry is at Verviers and the neighbourhood, extending as far as Liege and Maestricht. Verviers has risen in a few years to a town of 16,000 inhabitants, and contains the extensive houses of Biolley and Son, Engler and Co. and others. It is carried on also in and near Antwerp, and particularly by De Vreede, Dieppen and Co. and Van Dooren and Co. at Tilbury in North Brabant; at Delft; and at Leyden for exportation to the East Indies. The Netherlands cloths are much sought for, both from their quality and price, and might have been formidable rivals to our own, had it not been for the timely reduction of the wool duty. It is difficult to ascertain the quantity made with exactness, but in calculating the home consumption of woollens at twenty francs per head for a population of six millions, who use at least one-third of home manufactures, and adding to this third an equal amount for exportation, the value of the cloth manufacture will be 80,000,000 francs a year.

The linen manufacture flourished in Holland in very ancient times, and linen cloth of beautiful whiteness and fineness is still made at Bois-le-Duc, Endhoven, and Gehmert. The table linen of Helmont, of Bruges, and of Courtrai, is remarkable for the elegance of its designs and the fineness of its texture. The sail cloth of Holland and Flanders, the ticking of Turnhout, and the bâtiste of Ghent, are well known, as are also the threads, for sewing and for lace, of Termoude, Ghent, Brussels, Courtrai, &c. The bleaching grounds of Harlem and Courtrai are the principal. The linen manufactures are chiefly in Flanders; among the exhibitors in 1820 at Harlem, Messrs. De Cercq, Bleeckere, De Vos, Robetti, Verheyden, and others, residing in these provinces, were distinguished; M. de Beer, of Ghent, sent there a piece of cloth of four ells in width; and the specimens of M. Plankaert, of Courtrai, also excited much attention.

There are in East Flanders 31,697 looms employed in weaving flax, 6124 for cotton, and 639 for mixed stuffs. Audenarde and St. Nicholas are the districts in which flax is chiefly cultivated; the latter alone contains 3800 bonniers sown within it, which yields about two million pounds a year, one-third of it being exported to England and elsewhere. It is in the cottages of the small proprietors, owning

from 3 to 5 bonniers, that the machines are mostly in motion, because they employ the evening of themselves and their families in a kind of work which it is often not worth while for the large farmers to hire people to do. Independence and industrious habits are thus acquired by a numerous peasantry, who bring to market the stuffs manufactured by themselves from the produce of their own ground. The linen manufacture is, no doubt, capable of still further extension, and if the plan proposed by some influential persons in Flanders can be effected, for raising a fund to advance money to the peasantry for the purchase of machinery, and to establish additional markets for the greater convenience of sale, the people of these districts may make their labours even more productive than at present, and use their boys to the loom and their girls to the spinning wheel from their earliest years. The linen trade with France has been much checked by the high duties in that country, amounting to 20 per cent. on unbleached and 40 per cent. on bleached linen. Hence many bleaching establishments have been removed into France, and it is a common thing for the weavers who reside near the frontier to cross it to perform their work, so as to obtain the advantage of sale in France free from the excessive duty. However, the Netherlands weavers have no great reason to complain of their situation, for it appears that in East Flanders alone the average market sale of linens for the last ten years has amounted to 177,385 pieces, and adding one-tenth for the quantity disposed of by hawkers, 195,124 pieces. The price of the flax varying from 50 to 135 cents the pound, the value of each piece may be taken not unfairly at 35 florins, so that the produce of the linen manufacture in one province only is 6,829,340 florins; the profit, at the low rate of 2 florins the piece, 390,284 florins.

The following table will show the progressive increase in East Flanders for ten years, according to the returns of the nine principal markets for that province.*

Number of Pieces of Linen sold in

	1816.	1820.	1825.
Ghent	56,923	60,281	55,650
Alost	35,000	35,000	35,000
Rousse	31,200	31,919	34,570
Oudenarde	21,000	22,300	24,000
Geerartsbergen	15,000	19,000	24,000
Lokeren	3,640	3,363	4,576
Deynse	.....	.....	2,400
Wetteren	.....	.....	2,390
Sotteghem	1,700	1,900	2,100
	16,4463	173,763	184,686

* Proef op de aanmoediging en uitbreiding der Linnenweveryen in Oost Vlaanderen, poor Ir. A. J. L. Van den Bogaerde, Beschryer van het Distrikt St. Nicholaas, voor heen Land van Waes. Te Gent. 1829. (Essay on the Encouragement and Extension of the Linen-weaving in East Flanders, by Mr. A. J. L. Van den Bogaerde, Overseer of the District of St. Nicholas, for the Land of Waes. At Ghent, 1829.)

The tendency of the linen manufactures to spread from towns into the smallest villages, is favourable to their increase, and they are, we believe, generally thriving in other parts of the country, particularly in Hainault and Friesland. Judging from the annual production and importation of hemp and flax, the value of these manufactures, including the bleaching and every necessary ingredient of completion, cannot be less than 105 to 115,000,000 florins.

The lace trade has, we understand, not much augmented of late years; but the three sorts, those of Brussels, of Mechin, and of Valenciennes, retain all the delicacy and richness for which they have long been famed. MM. Ducpetaiux, Galler-Liegeois, Meeus-Vanderborcht, Verbecht-Haye, Vispoel, Deliagre, Van Peteghem, &c. have sustained the reputation of their several cities by the specimens exhibited at Ghent and Harlem. The cheapness of tulle in France, where it is now made to a great extent, (a proof of which may be seen at Calais, where upwards of 5000 people are employed in it,) has probably interfered with the demand in that country for the more costly work of the Netherlands.

The rise of the cotton trade, or rather its resurrection, since the termination, at the peace, of Napoleon's prohibitory system (which forced it here as well as in France beyond all reasonable bounds) is very striking. The spinning establishments are principally in East Flanders and Brabant; and stuffs of all kinds, calicoes, ginghams, perkales, and printed goods are made in abundance at Ghent, Brussels, Antwerp, Courtrai, Bruges, Ypres, Lokeren, and St. Nicholas. At the exhibition of 1820 there were 35 exhibitors of cotton stuffs, and at that of 1825, 66, and although the manufacturers were not particularly forward in displaying their products, yet some of the principal houses had no reason to regret their doing so, among whom were M. Basse, of Brussels; MM. Davis, and Engler and Co. also of Brussels; MM. Godefroid, Poelaert, Poelman, and Feroucke; De Smet, De Vos, De Vos-Bauwens, Vander Waerden and Co., and Sauvage and Co. of Ghent, and many other manufacturers equally well known. It is at Ghent in particular that this trade flourishes, as may be judged by the fact of its containing 68 steam engines for spinning and weaving, while 25 years ago there was not one in all Flanders, the first having been erected by Messrs. Edwards in 1805. Ghent receives annually 40,000 bales of cotton wool, and the new canal, intended to communicate with the Scheld at Terneuzen, will give additional facilities for procuring the raw material. The price of labour is very low at Ghent, compared not only with other countries, but with other parts of the Netherlands; it being but 15 sous a day, while at Antwerp it is 26 sous. The necessity of purchasing from England is almost superseded; and in spinning cotton of the low numbers, from 20 to 40, the manufacturers can already compete with us; a circumstance of some moment, considering the large quantity of cotton of this description we supply annually to the north of Europe.

These favourable circumstances have also contributed to the success of the sugar refineries at Ghent and in the neighbourhood, which

have been on the decline at Amsterdam and Rotterdam. About twelve million pounds of sugar are annually refined in the first mentioned city.

The distilleries of Holland are in a very prosperous state, and the name of Shiedam appears to retain its fame throughout the world. The circumstances of the distilleries thriving better here than in the corn provinces of Belgium, may be accounted for by the facilities of exportation from Rotterdam, the fact being that $\frac{98}{100}$ths of the Geneva made at Schiedam are sent to the East Indies. This Geneva acquires a mildness and an oily flavour as it grows old, which the Hollanders are said to dislike; it is made solely of the spirit of rye and barley, flavoured with juniper berries. There are 300 distilleries at Schiedam, 100 in other parts of Holland, and about 40 in the other northern provinces; the average produce of each is 4992 ankers a year, which gives a total of 2,152,762 ankers. Deducting, however, a third, and estimating the distillation at 1,400,000 ankers, this branch of industry will be found to produce about 34,000,000 francs, of which about two-thirds are exported. This calculation, however, only extends to the northern provinces, as we have not the means of making an estimate for Belgium, where the distilleries are comparatively few and inactive.

A vast number of hands are employed in Holland in brick making, particularly at Utrecht and Dordrecht. These bricks are used not only for building, but for the roads which present so curious an appearance to strangers, and would indeed be but ill calculated for their purpose, did not all merchandize, and $\frac{19}{20}$ths of the passengers travel on the canals. The figures in which they are laid down are not less striking than their colours; they are about 7 inches long, $3\frac{1}{2}$ wide, and $1\frac{1}{2}$ in thickness.

We should hardly be expected to notice the breweries, did not their trade extend far beyond that of home consumption. "La bonne bierre de Louvain" is exported in large quantities; there are between 30 and 40 breweries in that city, which make about 4000 tuns each monthly. Brussels has above 40 breweries, and Mechlin 25; which latter are famous for the kind of ale called Faro. The consumption in the kingdom may be reckoned at $2\frac{1}{2}$ cents a head; and of the two sorts of beer in ordinary use, the better is 11 cents (less than 2*d.*) and the inferior 7 cents (less than $1\frac{1}{4}$*d.*) per pint. Both of them are perfectly wholesome, and though perhaps dearer than they ought to be, are not so heavily taxed as to drive the people to the abominable refuge of spirit drinking—now one of the fertile sources of crime and misery in England.

As we have now spoken of those branches of manufactures which appeared to require special mention, we shall conclude the subject with a table of the value of the present manufacturing industry of the kingdom, according to its various divisions. If our authorities should have, in any instances, led us into error, it is assuredly without the slightest inclination on our part either to exaggerate or diminish.

State of the present manufacturing Industry of the Netherlands.

Substances.	Value in Fr.
Iron*	46,000,000
Copper	5,000,000
Woollens	80,000,000
Linens	95,000,000
Cottons†	50,000,000
Sugar (refined)	14,000,000
Salt (do.)	10,000,000
Spirits‡	40,000,000
Beer	110,000,000
Tobacco§	28,000,000
Oil	30,000,000
Soap	10,000,000
Lace	25,000,000
Leather	28,000,000
Earthenware and Pottery	4,000,000
Bricks and Tiles	6,000,000
Printing and Books	15,000,000
Bleaching	10,000,000
	606,000,000

Substances.	Value in Fr.
Brought over	606,000,000
Dying	10,000,000
Paper	8,000,000
Caps and Bonnets‖	7,000,000
Cheese	10,000,000
Jewellery	4,000,000
Starch	3,500,000
Acids and Salts	1,500,000
Cordage	3,000,000
Hats	6,000,000
Glass	2,000,000
Clocks	4,000,000
Cards	1,200,000
Embroidery	1,200,000
Turnery	600,000
Lead and Zinc	1,000,000
Miscellaneous	4,000,000
Total¶	673,000,000

The sum, therefore, of the manufacturing industry of the Netherlands amounts to 673 million francs, or £28,125,000 sterling per annum, of which we may state one-third to be composed of the profits of the labourer and the capitalist, according to M. de Cloet's calculation. The artisans in the country are about 13,000, and those in towns about 77,000, in all 90,000; whose wages at 1¼ franc a day (which, perhaps, rather exceeds the average) for 300 days, amount to 40,500,000 francs per annum. Deducting this sum from 225,000,000, the third of the total value, there remains a profit to the manufacturer of 184,500,000 francs, or about 28 per cent. on the gross produce, including the interest upon his capital and stock.

NOTICE.

The distance between the editor and the printer frequently interferes with the insertion of some small articles reserved for the "make up;" this, and the space occupied by the index, prevents the publication in the present number of several notices of books, which the editor had prepared for insertion; they shall appear hereafter. From two quarters he has received letters requesting his opinion of the value of the *Encyclopedia Americana;* he has now only space to say, those who would be induced to subscribe for it in consequence of his favourable judgment, need not delay. There are few who will not find something to interest and instruct them on every page.

* Including 24 millions of cutlery, hardware, and nails.

† Including the several branches of spinning, weaving, and printing.

‡ Reckoning only 6 millions for Belgium.

§ Estimating the consumers at 2 millions at 7 lbs. each, and the exportation at an equal amount.

‖ Of woollen, linen, and cotton.

¶ M. de Cloet makes it, in 1824, 600 millions.

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